SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LI.—No. 15. [NEW SERIES.] NEW YORK, OCTOBER 11, 1884. [$3.20 per Annum. [POSTAGE PREPAID.]

1. Lolly Cave. 2. Nelly's Grotto, Imperial Cave. 3. Lucinda's Columns. 4. Columns, Nettle Cave. 5. The Shawl Cave. 6. Crystal Salt Pans.

THE FISH RIVER CAVES, NEAR SYDNEY, AUSTRALIA.—[See page 229.]

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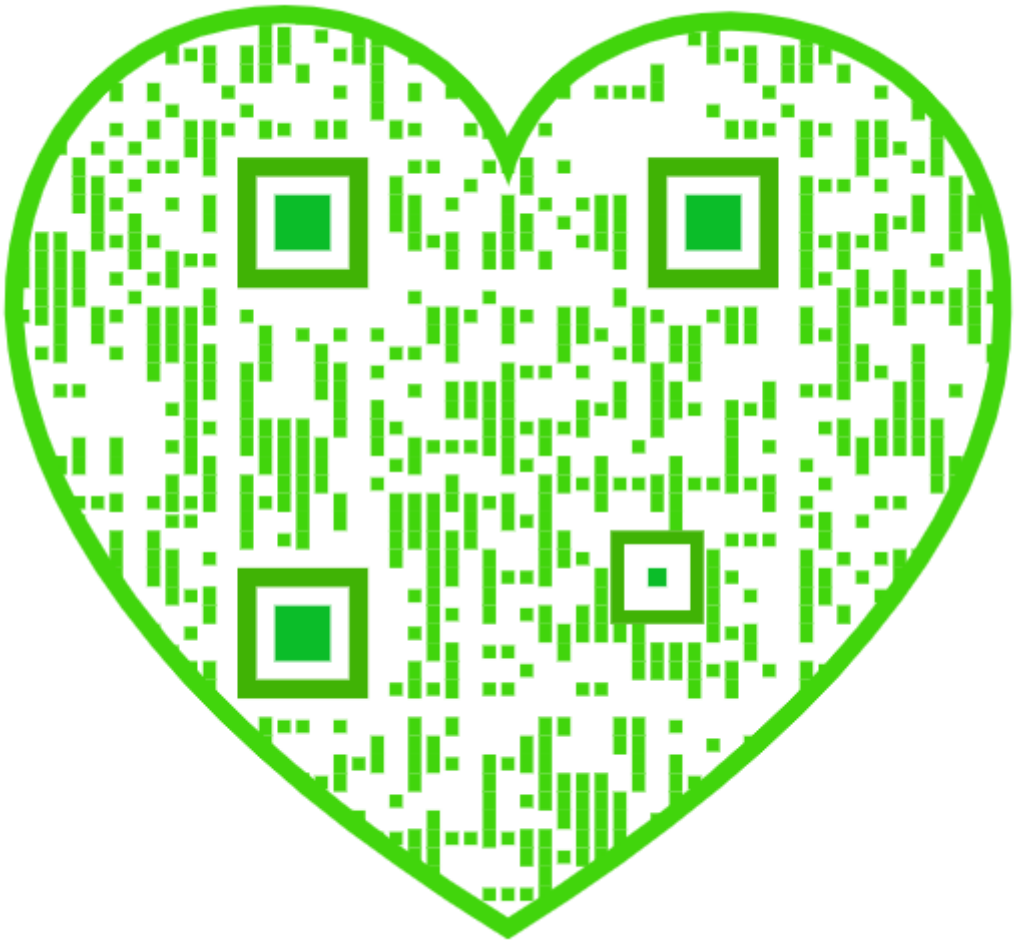

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

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One copy, six months postage included 1 60

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NEW YORK, SATURDAY, OCTOBER 11, 1884.

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LEVELING AND LINING SHAFTS.

With the best of care, the main line of shafting and the intermediates and counters will sometimes get "out of kelter," from several causes. It is difficult to make a building perfectly secure in its foundations and superstructure; the walls settle, the foundations may be affected by frosts and by profuse rains, the floors become unlevel; the main shaft is unduly loaded and unevenly pulled by newly added machinery; oil holes become clogged, and other small causes may combine to disturb the relations of prime mover, main shaft, and the other lines that are intermediate between main shaft and machines.

It will not pay to go over the entire work of hanging the shafting as originally done, so some data should be established at that initial period to rectify by, when minor changes occur. It is a very good plan, therefore, after lining out, or squaring out from the prime mover to the main shaft, to keep the lines. In practice the writer has found that the brass nails, convex-headed, which are used for ornamental furniture purposes are good, or copper tacks, either of them being driven into the floor at convenient distances to designate the exact lines, the lines having been originally found by the plumb bob. One word as to this implement; as usually made, it is not a tool of precision; a pear-shaped pointed weight can rarely be suspended by a central string so that the point will touch a point at all times, and not describe a minute circle. A plumb bob should be a circular weight like a solid ring suspended horizontally by three lines, like an old fashioned balance, meeting in one, and have a projecting downward center. Some toy tops show the proper shape for a plumb bob.

If these brass-headed or copper-headed marks have not been left on the floor from the original lining of the shafting, they should be made subseqently, taking, by square, the central line of the engine as a basis. This square having been established, plumb from the center of one end of the shaft or from one side of the shaft, and then at intervals to the other end. By drawing a connecting chalk line on the floor a determination of absolute line may be made by squaring to the engine. Of course, when the main shaft is lined all the other shafts may be brought parallel with it by means of rigid reachers, as light wood staffs, or flexible ones, as linen tape lines. But for all lining purposes the writer never found anything better than the ordinary fishing line of flax, of the size suitable for fresh water perch or pickerel fishing. It keeps its length under quite considerable hygrometric changes of the atmosphere, and one hundred feet of it may be conveniently carried in the pocket. All this relates to the lining of the shafts; now as to the leveling, which is of fully as much importance.

A shaft may be in line with the prime mover and in relative line with the intermediates, and not be right. It may be, also, perfectly straight, so that a line stretched from end to end through the boxes would show no deflection, and yet not be right. The shaft should be level; and then, if the pull on it is evenly balanced, or nearly so, there will be no "creeping," even if there are nether coupling hubs nor stay collars set up against the ends of the boxes to prevent end movement. It is possible (because it has been done) to run a line of two and three-quarter inch shafting 220 feet without a turned journal or a guard collar in its entire length; but to do it the shaft must be level.

A handy implement for leveling the shaft can be made in any carpenter's or patternmaker's shop. It is a frame, well braced, made of light wood, pine or spruce, consisting of two upright arms of a length sufficient to reach from the shaft to the operator's shoulder. These have at the upper end a cross piece secured at a right angle, or an angle somewhat more acute, so that the elbow thus formed would embrace or rest on the shaft. These uprights are connected by cross bars at a convenient distance for handling the uprights and for reaching between pulleys, so that each upright can rest on the shaft. The lower cross piece should carry a spirit level, or one may be carried separately to use with the appliance. It is evident that the frame must be strongly braced to prevent any "withing," or sagging, and that the lower, or spirit level, bar must be at an absolute and exact distance from the forked ends of the upright. In use, the shaft to be tested must be at rest.

With this simple implement the exact level of a shaft may be found, or rather any deviation from the level may be ascertained. A combined level and plumb, such as is used by carpenters and masons, can be used to determine the accuracy of the implement at any time. It is handy to have in the shop.

TURNING METALS TO PATTERNS.

A workman in a machine shop had a job of turning, tapping, and finishing some ornamental brass nuts of an almost globular form—hemispherical with a moulded base. At first he drilled into the end of a bar of the metal of the proper diameter for finishing, tapped the hole, cut off the nut in a lathe, mounted it on a threaded arbor, and finished it with a hand tool. Each nut was treated separately. It was a process too slow to suit his tastes; and after ascertaining that the job would extend to several thousands of dozens of nuts, he obtained permission to contract for it. He procured the use of a lathe and a turret head screw machine. He removed the transverse feed screw of the tool carriage of the lathe, and substituted a strong spring.

On the back of the lathe he mounted a guide for the tool carriage in the form of a series of steel plates with escaloped edges mounted on a horizontal spindle. There were four of these plates, each successive one having deeper indentations, until the fourth one presented a profile of the almost completed nuts. The spring held the tool carriage firmly against one of these escaloped guides, compelling the cutter to make a chip in accordance with the profile of the guide. The successive guides had indentations, or escalops just suited to the taking of a fair chip. The bar to be turned and the guides were of the same length. Soon as the tool carriage had reached the end, a star wheel and pin changed the pattern or guide. At first the lathe was allowed to stand still until the tool carriage was again returned to its starting point, but after a while a simple attachment reversed the longitudinal feed automatically, holding back the spring until the tool carriage came into place, thus making the lathe an automatic machine.

When the bar was turned into the nuts, they still, however, being slightly connected by their necks, they were broken apart and each one put separately into the chuck of the turret head machine, drilled, squared at one of the ends, and tapped. For the finish, a short threaded arbor was inserted in the chuck, the nut mounted and polished. The practical machinist will readily understand these processes and the increase of rapidity caused by the automatic turning and the use of the turret head machine, which carried all the tools ready fixed in place for use—the drill, the squaring up bit, and the tap.

It seems to be apparent that an extension of this method of turning to pattern steel, iron, brass, and other metals is feasible, and might be applied economically in many instances where reproduction of forms is required from the lathe. It is a modification of the Slate taper attachment to lathes, and is carrying only a little farther that principle which has already been extended to the crowning of pulley faces and the finishing of iron hand wheel handles.

Car Couplers on Massachusetts Railways.

According to the provisions of a law enacted last winter, requiring Massachusetts railroads to adopt safety couplers on all new freight cars after this year, the railroad commissioners of that State devoted Sept. 25, 26, and 27 to a consideration of the claims of various styles of couplers for superior excellence. There were applications for the examination of 173 different couplers, which were called up in alphabetical order according to the names of their inventors, some of whom were represented by counsel. In so long a list of course only the merits and demerits of each can be but briefly touched upon in the following synopsis of the results of the examination:

Among those presented were the Archer (hook and link), which has been in all the tests, and is recommended by the National Car Builders' Association for further trial. It has been in use on 100 cars of the Delaware and Hudson for two years, also on the Lackawanna. It couples automatically with itself and all others.

The Ames coupler is a combination of link and hook, fixed, automatic with itself but not with others, and was represented as strong, durable, unfailing; it has been in use on 150 Boston and Albany cars four years, and about 50 Lake Shore cars six years; has not broken for two years; costs, all steel, $20 a car; malleable iron, $18; iron, $14. The patent has been passed upon by both the Eastern and Western Railroad Associations. Mr. Adams, the master car builder of the Boston and Albany, testified to its success, and in reply to a question by Chairman Russell, said he should prefer it to any other if all roads would adopt it.

The Best automatic has link and pin, couples with "anything or nothing," uncouples easily without much slack if desired, and never if not desired, and both the link and pin are adjustable by one lever and with use of only one hand. The promoter said it was open to only one objection, and that was a loose link, which is liable to get lost or stolen. The pin is protected from ice and gravel, and free from breakage. Total weight, 250 pounds; cost, $11.20 a car, exclusive of royalty. The pin is flat and broad. It is in use on 12 cars of the Denver and Rio Grande, where it has stood the severest possible tests. No cars are here.

The Barnes automatic couples by a hook underneath the head, movable from six different standpoints, works on shortest curves, and will uncouple at an angle when a car tips over. Eight pairs are in use on the Rochester and Pittsburg.

The Brown automatic has link and pin, and works in a double head (for high and low), inside of which is a simple device, costing only 15 cents, with gives the automatic action. Fifty cars equipped with it are in use on the Chesapeake and Ohio, and some on several other roads. The pin is fast, does not bend or break, and ordinary links are used. It will require new drawheads on most roads.

Byron's self-acting coupler is of the hook variety, somewhat like the Miller, but the hook has a deeper angle. The cars stand but 27 inches apart, while with others they are from 26 to 42. It will couple and uncouple on the shortest curve in use. It has been tried on one of 56 feet radius, and with both hooks drawn back there were 8 inches of space to spare. It will not couple automatically with other kinds.

The Beal coupler, link, and pin, the latter secure, works automatically with all, and is in successful use on the Florida Railway and Navigation Company's roads.

The Boston automatic comes from Minneapolis. It is of curved vertical hooks, automatic with each other only. Couples and uncouples easily; is strong, safe, and durable. It costs about $30 a car, exclusive of royalty.

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The Charles C. Burton coupler, link, and fast pin, works automatically with all others, is operated from sides and top, and costs about a quarter more than ordinary drawbars.

The Carman Ball coupler has a fixed ball on the end of the drawbar, which enters opposite drawhead. It has not been in actual use.

The Conway ball coupler has a loose ball in each drawhead, uses link but no pin, works automatically with others, and costs about $10 a car. It can be worked from side or top, but promoter said good railroad men object decidedly to working any coupler from the top of the car, as being hazardous and unnecessary. This coupler is one of the eight recommended by the master car builders for further test. It is in use on numerous roads. Two letters were read showing wherein it had failed, by the breaking of its working lever. Commissioner Kinsley remarked that it would have to be seen.

The Eureka coupler is automatic; is in use on the Grand Rapids and Indiana road on 400 cars, and has been for three years. Certificates from officers at the West were read.

W. L. Everett's coupler has been in use on the New Haven and Northampton road 18 months.

W. H. Flagg's attachment to the old fashioned pin and link coupler was explained.

Gifford's automatic coupler is in use on the Michigan and other railroads. It is a combination of a quarter circle and an inclined plane. Its cost in cast iron is $8 per car; in malleable, $13; and in steel, $16. It is used on 8,000 or 10,000 cars now in service, and is the standard draw bar of the Erie Railroad. That road has 2,000 cars with it attached. Several other roads were named where it is used.

Manly Howe's coupler was shown in model in a new form. It has been tried successfully on the Albany road in another form, of which the new one is an improvement.

The Hatfield coupler has been tested satisfactorily on the Boston and Maine Railroad.

W. S. Huntington's coupler is in use on two cars on the Erie Railroad.

A. B. Holme's coupler has been used with great success on coal cars running from Scranton, Pa.

The Hine coupler has been used on the Chicago and Rock Island Railroad, the New Haven and Northampton, and two other roads.

R. Hitchcock's coupler has been used nearly a year on the Connecticut River Railroad; costs $9 per car.

Hilliard's coupling is in use on the Grand Trunk road and the New York and Northern, and one other road.

Charles M. Hoag's coupler has been used to some extent on the Boston and Albany Railroad.

Hubbell & Co.'s coupler is a balance weight to hold the link level. No hooks, chains, bars, or rods are required, and it is improved by being made hard and smooth by use. It cannot be banged to pieces in 100 years. The St. Johnsbury and Champlain Railroad have used it 27 months, all the time, having but a scant number of freight cars on their road.

John Howe, Jr., showed a device for adjusting the ordinary coupler from the outside of the car.

The Janney coupler was explained at some length. It is in very general use. Among the roads having it are the Chicago, Burlington, and Quincy, the Chicago and Alton, and the Pennsylvania road. The latter has 3,500 cars equipped with it. Cars furnished with it cannot be telescoped.

Charles K. Cordrey presented the merits of his attachment for coupling and uncoupling. He had not made arrangements for exhibition on any railroad, nor is his apparatus in use on railroads.

W. Emmett showed his model for easy shackling and unshackling of trains, which he claimed greatly simplifies the work of the train men and reduces the danger. He had just got his patent, and had no car on a railroad in use with his apparatus.

Mrs. Susan P. Moulton showed a coupling of simple construction and low cost.

The Maulick coupler was shown. It is an attachment to the old-fashioned link and pin. It works with a spring, and is in use on a coal railroad running from Pittsburg, Penn., since February. The link and pin coupler, the exhibitor thought, will not go out of use for a long while, and this attachment makes it automatic.

Henry Mitchell showed a simple coupler, which is not yet in use. It costs $18 or $20 per car.

T. B. Nutting's coupler unshackles from the top of the car, and in case of accident will uncouple itself.

Simeon Nichols' apparatus works with a link and pin, and is easily manipulated from the top or side. It has been used on the Boston and Maine Railroad.

H. M. Sturgis' coupling is a coupling without a link or pin. It is of simple construction, and was patented last June, but is not yet in use.

Peck's coupler was shown. It has been tested on the Wheeling and Lorraine Railroad, and its superintendent certifies to the merit of the device.

The Marks coupler was explained, but the model was not shown. It is in use a year on the Cleveland road. A link is used, but not a pin.

The Loraine coupler was shown. It works automatically, and can be operated when there is a tension on the train. It is not yet in use.

The Leonard and Snow coupler was shown as very simple and at low cost, but not yet in use.

Powell's perfect coupler. It is in use on the Southern Kansas and on the Atchison and Santa Fe roads to some extent for six months past.

James Scofield's coupler was shown. The Texan Pacific road has had it in use five or six months. A certificate from the superintendent was read. The cost will not be more than $1 a car.

The Skinner car coupler works with a link and pin, and is a new adaptation of the old style coupler. It is of recent patent, and is not yet in use.

Turner's coupler works in with the regular system and couples with any other. It has a hook and lever. Its cost is 60 cents. It has been used hauling freight trains of 30 and 35 tons per car, running over Alleghany and Ozark Mountains. The St. Louis and San Francisco and Baltimore and Ohio use it.

It appeared in answer to questions put by S. W. Hatheway, attorney for the Boston Automatic Car Coupler Company, that the Hine coupler claimed to be almost identical with the Boston automatic car coupler, and that the Janney coupler claims to have originated whatever is good for anything in the Hine. The Hine is in use on the New York, New Haven, and Hartford and the New Haven and Northampton railroads and others. It seems that in the use of the Janney coupler it is necessary for a brakeman to go between the cars and throw out the loose pin, so as to leave it ready to couple, and that this is not so in the Boston automatic. All three of these couplers are automatic swing hooks, dispense with links and pins, and couple with old style, and all three are anxious for tests.

Among the other couplers explained were the United States and the Union, both in extensive and successful use in New England; the Smillie, link and pin, in use on the Lackawanna; the Robinson, link and hook pin, patented July 22, 1884; the Thomas Wood, of London, Eng., hook and link; the Williams, patented last April, to be tested on the Fitchburg; the Wilson & Walker, of Fitchburg, combined link and hook, much like the Ames, but will uncouple by raising either link; the P. Ware, link and pin, automatic with others, costs $6 a car, not yet in use; the James C. Bond, hook, automatic with itself, not yet in use; the Titus, hook like Miller, except that it swings, couples automatically with other hook designs except the Janney, and is in limited use on the Chesapeake and Ohio; the Colburn, which is an improvement on the Miller; the Vance, new and not in use; the Breyhan attachment, common link and fixed pin; the National link and pin; the Coombs, automatic, hook and link; the Prescott, in limited and successful use on Central Vermont; the Stebbins, hook and link, automatic with itself; and the M. Ross, opposite hooks, catching into draw-heads, and both to be lifted to uncouple.

Many of the devices were strikingly ingenious, and a few seem to have come very near perfection, and will bear close study and careful tests.

The commissioners accompanied by nearly the whole party of inventors and promoters and by a few practical railroad men made a tour of the railroad yards of Boston and vicinity. At East Boston they saw tested the Mark and the United States. Both scored successes, and elicited much admiration. Of course nearly all present were in a critical frame of mind, and some were not backward in pointing out what they considered defects. The Mark coupler failed twice in coupling with ordinary drawbars—once on account of a link being so bent that there was not room for the hook to enter, and the other time because the concussion displaced the raised pin in the opposite car. The United States failed two or three times—once when the force was so great that the car on which it was placed was thrown back, and once when a low link was propped up so as to strike the lifting device of the pin at its highest point. In the former case it was explained that the car should have had the brakes set, or the approach should have been more gentle; in the latter it was claimed that the force was insufficient, as more is required when the link strikes the dog at the top. A train hand said that the failures were wholly exceptional. Some of the inventors, however, shook their heads, and said that the device required too nice an application of link and power; in other words, that it must be struck at just the right height and with neither too much nor too little force, or it would often fail. Aside from this it was generally admitted to be a good coupler. The promoters of it were quite annoyed by what they said was an unheard of slip in its working, and they will doubtless ask to have it observed in actual use.

In the Fitchburg yards tests were made of the Janney (hook), the Boston of Minnesota (hook), the Williams of Brattleboro, Vt. (book with a second shoulder), the Robinson of Ohio (link and pin), the Smillie of Newark, N. J. (link and pin, both attached), and the Archer (hook and link). All worked well, and almost equally well, but the tests were few, and could have served only to impart a general idea of the devices in action. After the commissioners have seen all and brought their preferences down to a few, they will necessaril ysubject them to longer and severer tests, or, better still, take the testimony of the train men and yard masters who have worked and observed them under all the circumstances of ordinary use.

At the Lowell Railroad, half a dozen varieties of couplers were tested. All the tests were substantially alike, and consisted of pushing one car slowly against another, and at another time throwing one car swiftly against another. Efforts were thus made both to couple and to avoid coupling. The Ames automatic coupler of Canada was first tested. It consists of an inverted hook, which catches and holds the link automatically. This coupler worked well. The Byron coupler was not shown. It consists of a hook, which couples with the standard link. The Conway ball coupler, which has a loose ball in each drawhead, was the third one tested. It uses the link, but replaces the pin with the ball. It was one of eight recommended by a committee of the master car builders. The next shown was the Hubbell, which was a balance weight to hold the link level. The Union is too well known in this vicinity to need much description. It consists of a long latch fastened in the drawbar, which drops down of its own weight into the standard link. The Prescott is another invention using the link and hook. All the above worked satisfactorily in most of the tests to which they were subjected. The freight yard of the Boston and Maine was next visited, and tests made of the Holmes coupler, which uses a hook in place of the common pin. It worked well.

At the yard of the Boston and Providence road cars were examined which were equipped with the Cowell coupler. This is one of the eight recommended by a committee of the Master Car Builders' Association. It consists of a hook working horizontally, and does away entirely with the link and pin. It is similar to the Janney coupler, but has the advantage that it can be uncoupled from either car. The tests were eminently satisfactory, not a single failure being recorded. From this place the commissioners proceeded to the Boston and Albany's freight yard, west of Huntington avenue. The Ames coupler was first tested; it has a link of a peculiar form, the lower side having a "lug" or projection which enters the link of the next car; the link is weighted at the rear end, and is thus kept level. The Ames is another coupler recommended by the Master Car Builders' committee. The tests resulted very satisfactorily. Charles M. Hoag's coupler was next tested; it uses the standard link, and a double pin is the principal point of novelty. The Hitchcock coupler was the invention of the master car builder of the Connecticut River Railroad. It uses the standard link and a pin shaped somewhat like a half moon, which is worked up and down by a lever, though the pin works automatically by contact with another coupler. The Hein coupler has a horizontal hook, working automatically with one of its kind. Most of the tests of the above were satisfactory in their results.

The Old Colony freight yard in South Boston was next visited, and the Wilson automatic coupler, another of those recommended by the Master Car Builders, was first shown. It is very like the Ames coupler, but it was thought had some decided improvements, one being that it can be uncoupled from either car. The tests demonstrated that it is an excellent coupler, certainly equal to any shown during the week. The Davidson coupler, using the standard link in connection with a pin of a peculiar shape, was tested with satisfactory results.

The freight yard of the New York and New England road, on South Boston flats, was the last place visited. Turner's coupler was tested on four cars of the Baltimore and Ohio railroad. It uses a link and vertical latch or pin, but, as a special link has to be used, it is scarcely probable that it will come into general use. One gentleman said that it was a step backward. The tests were only partially successful, and utterly failed when a standard link was used. Peck's coupler was next tested. It uses a pin and link, both fixed, and the tests were quite satisfactory. A coupler patented by Mrs. Susan P. Moulton was the last one tested. It consisted of a barbed tongue, the barbs on two couplers coming together, catching each other. It worked only partially successfully.

At all the tests a large number of gentlemen were present, and many brakemen watched them with special interest, expressing freely their views, which appeared most favorable to the most simple styles of couplers, and any coupler that used automatically the link and pin especially commended itself to them.

To Make Koumiss.

Koumiss is considered a good restorative, and is undoubtedly a help to digestion. It can be made by any one. The following directions for making it are from the *Weekly Medical Review:*

Fill a quart champagne bottle up to the neck with pure milk; add two tablespoonfuls of white sugar, after dissolving the same in a little water over a hot fire; add also a quarter of a two cent cake of compressed yeast. Then tie the cork on the bottle securely, and shake the mixture well; place it in a room of the temperature of 50° to 95° Fahrenheit for six hours, and finally in the ice box over night. Drink in such quantities as the stomach may require. It will be well to observe several important injunctions in preparing the koumiss, and they are: To be sure that the milk is pure; that the bottle is sound; that the yeast is fresh; to open the mixture in the morning with great care on account of its effervescent properties; not to drink it at all if there is any curdle or thickening part resembling cheese, as this indicates that the fermentation has been prolonged beyond the proper time. Make it as you need to use it. The virtue of koumiss is that it refreshes and stimulates, with no after reaction from its effects. It is often almost impossible to obtain good fresh koumiss especially away from large towns. The above makes it possible for any physician to prescribe it.

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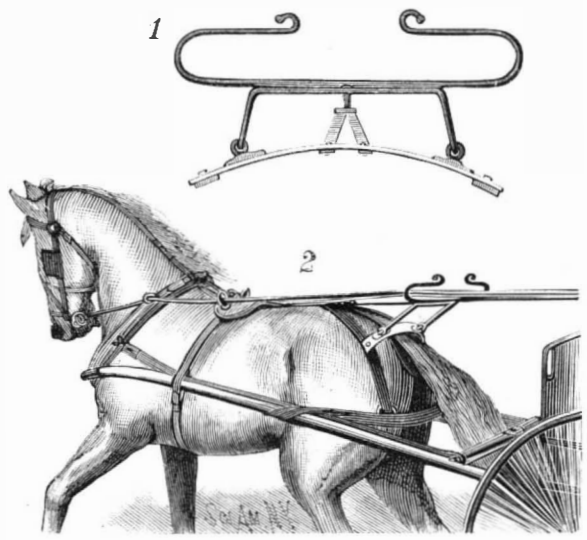
REIN SUPPORT.

The object of the invention herewith illustrated is to provide a device for holding the reins in such a manner that the horse cannot throw its tail over them. Each end of a U-shaped bar is provided with a leg, the lower ends of which are held on a plate fastened on a cross strap uniting the two hip straps. A brace rod extends from the middle of the bar to the back strap, and is of such length that the legs will be inclined upward and outward, as shown in the cut. On the bar is secured a rod which is parallel with the dashboard,



HOYT'S REIN SUPPORT.

and the ends of which are bent upward and toward each other to form loops (Fig. 1) that prevent the reins from sliding off the rod. The use of this device not only increases the comfort of the horse and relieves the driver of much care, but prevents the "cutting up" which many horses indulge in when they get their tails over the lines.

This invention has been patented by Mr. Edwin A. Hoyt, of Lebanon, Ill.

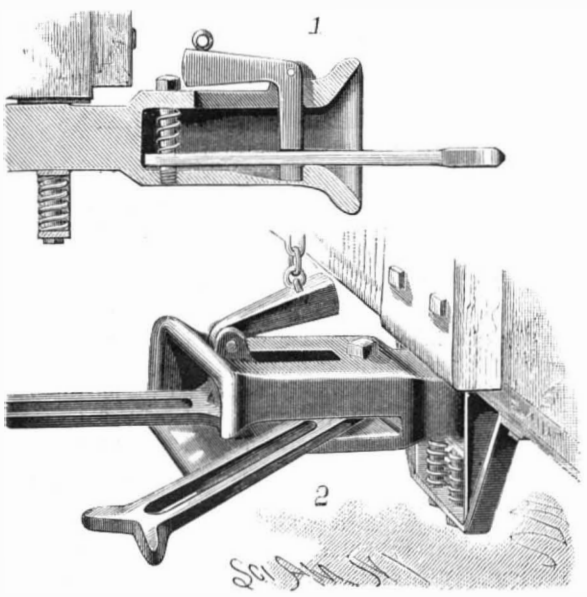
The New City Hall, Philadelphia.

This splendid edifice, now progressing toward completion, will have the highest tower of any structure in the world. The building is 489 feet 6 inches from north to south, and 470 feet from east to west, covering 4½ acres of ground. The width of the main tower is 90 feet at the base, and its height 537 feet 4 inches. The center of the clock face will be 361 feet above the pavement.

CAR COUPLING.

The drawhead of the coupling—shown in sectional elevation in Fig. 1 and in perspective in Fig. 2—is provided with two longitudinal slots, one in the top and one in the side. In the upper surface of the bottom is a groove, at the front end of which is formed a shoulder. Pivoted in the forward end of the upper slot is an L-shaped coupling pin whose vertical shank extends to the bottom of the groove and whose horizontal shank is weighted. Through the inner end of the slotted link passes a bolt carrying a spiral spring that presses the end of the link on the bottom of the drawhead. On the outer end of the link are formed prongs, which project in opposite directions. The inner end of the drawhead rests upon a cross plate sliding in a frame secured to the car, and is pressed upward by springs.

When the link enters the drawhead, the end strikes the vertical shank of the pin, which swings inward; when the end of the pin has passed, the pin swings back and through the slot in the link. Each drawhead holds a link, and as only one is used in coupling, the idle one is swung out of



SPENCER'S CAR COUPLING.

the way through the side slot. When the drawhead is to be connected with a car having one of the usual drawheads, a link is used having one end formed in the usual manner and the other end forked.

This invention has been patented by Mr. C. B. Spencer, of Spiceland, Ill., and particulars may be obtained from Mr. S. G. Hastings, of same place.

Stripping Photo Films.

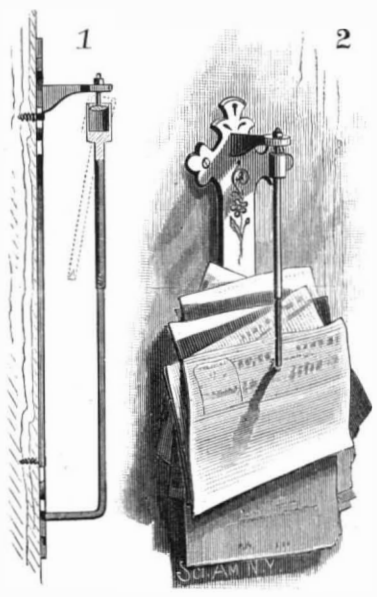
Take a developing tray larger than the negative to be stripped, pour in sufficient water to cover, and, for a whole plate, drop in eight or ten drops of hydrofluoric acid (the exact quantity cannot be given, as the strength of the acid is constantly diminishing, though kept in a gutta percha bottle), place the negative in the acidulated water, and in a minute or two the film will frill all round the edges and gradually leave the glass. If the operation is slow, add two or three more drops of acid, and gently rock.

When the film is loose, hold it at one end and pour off the acid water, and wash by repeated changes of water; this lengthens the film wonderfully, but if the last washing is done with equal parts of methylated spirits and water, it will return to its original size. This may be varied considerably by using more or less spirit. But on no account should undiluted spirit be used, as it makes the film coil out of all control.

Clean a plate with nitric acid—larger than the stripped film—dust with French chalk, polish with a dry cloth, and with a wet one wipe a quarter of an inch all round, coat with plain collodion, and when set, or even quite dry, introduce under the film. Adjust the film, and with a little care there will be no bubbles. Allow the film to dry, and coat with plain collodion. When this is dry, run a sharp penknife three-eighths of an inch from edge of plate, and you have the gelatine film between two collodion films, impervious to moisture, quite flat, and may be printed from either side. The acid is so dilute that any developing tray may be used.—*Photo. News.*

PAPER FILE OR HOLDER.

An improved file for filing bills, notes, and other papers has been patented by Mr. Oscar H. Gehrs, of Marine, Ill. From the upper end of a plate projects an arm, in the outer end of which is held a short rod having a button formed on its lower end. From the lower part of the plate a rectangularly bent wire extends upward, the free end of which is



GEHRS' PAPER FILE OR HOLDER.

pointed. A tube, or a rod having its lower end hollowed out, is provided at its upper end with a cup in which the button closely fits. When a paper is to be filed, the tube is moved upward and slightly to one side (as shown by the dotted line, Fig. 1), when the paper is passed upon the wire in the usual manner. The end of the tube is then placed on the pointed end of the wire to prevent the paper coming off.

If any desired letter is to be taken from the file, the letters above the one to be removed are pushed upward on the tube, which is then swung from the wire to allow the removal of the letter.

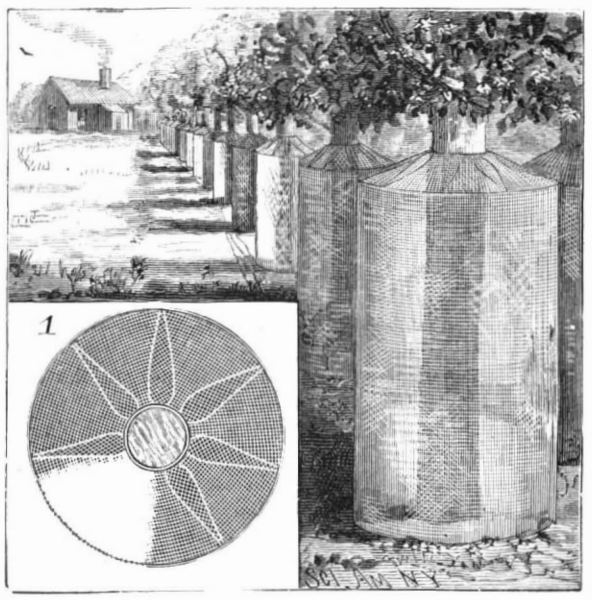
The Cholera in Southern Europe.

Cholera seems, from what we glean from foreign sources, to be passing away from Southern Europe. But our Continental exchanges still discuss the subject, and the people in many places exhibit the greatest alarm.

Dr. Vulpian does not venture on any forecast as to the probable course of the cholera epidemic, but he says that subcutaneous injections of morphine are the "grand remedy" on which the faculty mean to rely should the cholera make its way to Paris. Professor Germain-See was the first to witness the arrival of the cholera in Paris in 1865. It was brought into the city by a gentleman residing in the Boulevard Malesherbes, who had been to see his daughter in Amiens, where the scourge was raging. He died of it, and the whole of the quarter in which he lived became speedily contaminated, while the poorer quarters of the city enjoyed comparative immunity from the disease. Nervous people will derive comfort from the Professor's assurance that fear is quite incapable of producing the malady; and if, as is now practically proved, cholera is caused by the introduction of a specific microbe into the system, the statement may be accepted without hesitation. It is obvious that no extremity of nervous terror has the power to generate the smallest animalcule. Asiatic cholera was unknown in Europe before the year 1829–30, although it had existed in India for many centuries.

TREE PROTECTOR.

The tree protector shown in the engraving, recently patented by Mr. T. J. Longacre, of Kingsville, Missouri, is cheap, easily made and put in place around the tree, and forms a sure safeguard against damage from mice, rabbits, tree worms, and other pests. Plain, galvanized, or painted wire cloth of a fineness of mesh suited to the purpose is bent



LONGACRE'S TREE PROTECTOR.

so as to encircle the tree, the edges being sewed together with fine wire or cord.

The top is bent into a conical shape, the inner edge being close to the tree, and is creased to form radial ridges which, after the protector has been placed in position, are pressed down flat. This shaped top permits it to expand with the growth of the tree. The lower edge of the protector is placed in a shallow trench.

CAR GATE.

In the side wall of the car is inserted a series of tubes screwed into a plate, the openings in which are smaller in diameter than the tubes, in order to prevent the withdrawal of the bars. The gate is composed of bars projecting through the end wall of the car into the tubes, and secured at their outer ends to a vertical bar. The inner ends of the bars are provided with rollers to steady them in the tubes, and the vertical bar is furnished at its lower end with a roller that rests upon the car platform, and supports the outer end of the gate. The gate is formed with an eye in which engages either of the hooks attached to the end of the car and to the platform rail, to hold the gate in either an opened or closed position. A cord, secured to the upper end of the vertical bar, extends under a pulley attached to the wall of the car, and over pulleys which bring it within easy reach of the conductor; by pulling this cord the gate may be opened.

This car gate is applicable to street and railway cars and platform exits, and may be applied without material change either in the cars or in the building. It may also be adapted to elevator doorways.

Further particulars regarding this device may be obtain-

HUGHES' CAR GATE.

ed by addressing the inventor, Dr. C. H. Hughes, 3000 Chestnut Street, St. Louis, Mo.

THE sagacity of birds is illustrated by a pair of orioles in the Central Park, this city, who built their nest on a twig which they found too weak to support it. By means of a string ingeniously secured to the twig and branch above, the nest was properly secured.

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THE ELECTRIC RAILWAY AT FRANKFORT, GERMANY.

The cities Frankfort and Offenbach are now connected by an electric railway, 6,665 meters (about 4⅛ miles) long, of 39 inches gauge. It leads from the old "Romerbrucke" Frankfort through Sachsenhausen, Oberrad, and through the entire town of Offenbach.

The trains run over the entire route in about 25 minutes.

The annexed cut, taken from *Uber Land und Meer*, shows part of the engine and dynamo house of this railway.

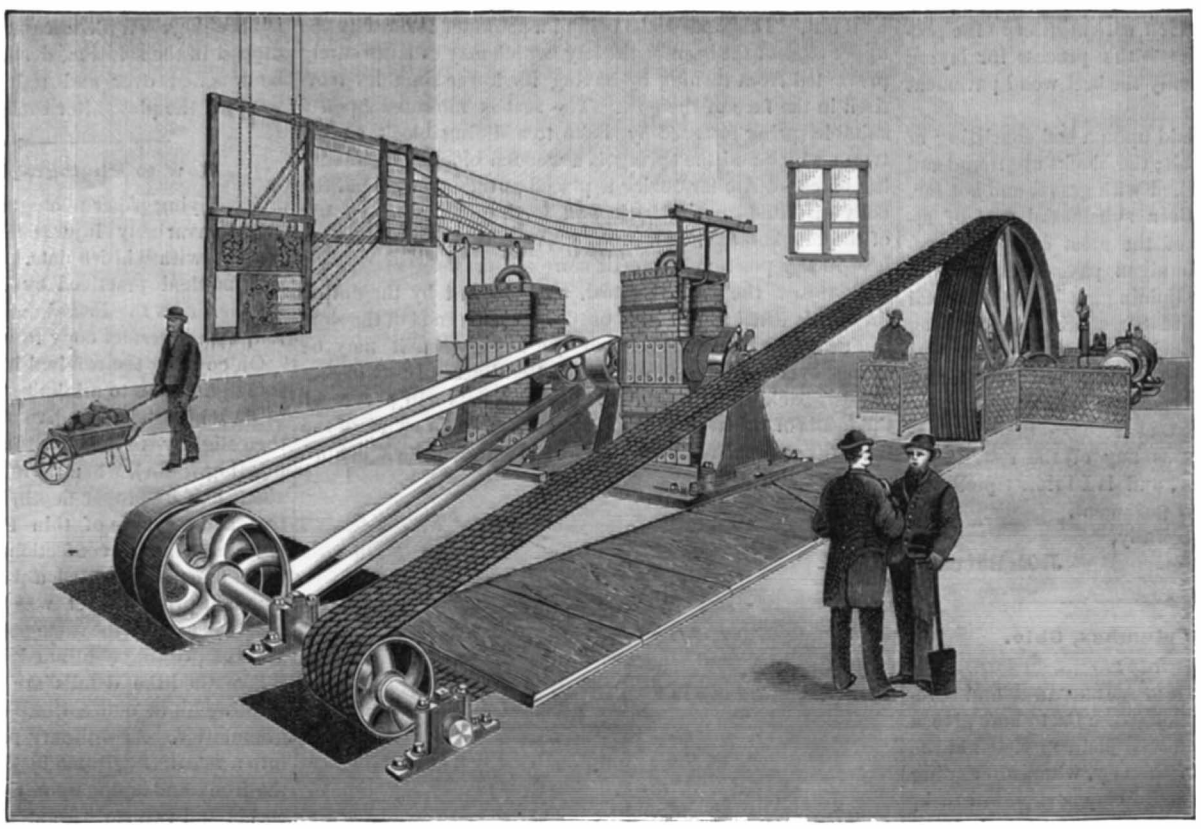
Two steam engines, of 125 horse power each, drive four dynamo electric machines by means of suitable cables, from which machines the current is conducted through suitable cables and conductors over the entire line.

A switch is provided, regulating, governing, and directing the currents, as may be necessary. The conductors consist of tubes slitted along their entire length at the bottom, and secured insulated on poles in about the same manner as telegraph wires are arranged.

In the said tube a small cylinder slides or runs, from which a conductor extends down to the car and to the dynamo in the same in the usual manner.

By using this conductor the interruptions, cut-outs, etc., are avoided which are caused by frost and moisture, when the carriage running on a conductor is used, as, for instance, as on the Berlin Lichterfelde Electric Railway.

The Frankfort-Offenbach Railway was built by the well known electricians, Messrs. Siemens and Halske, of Berlin.



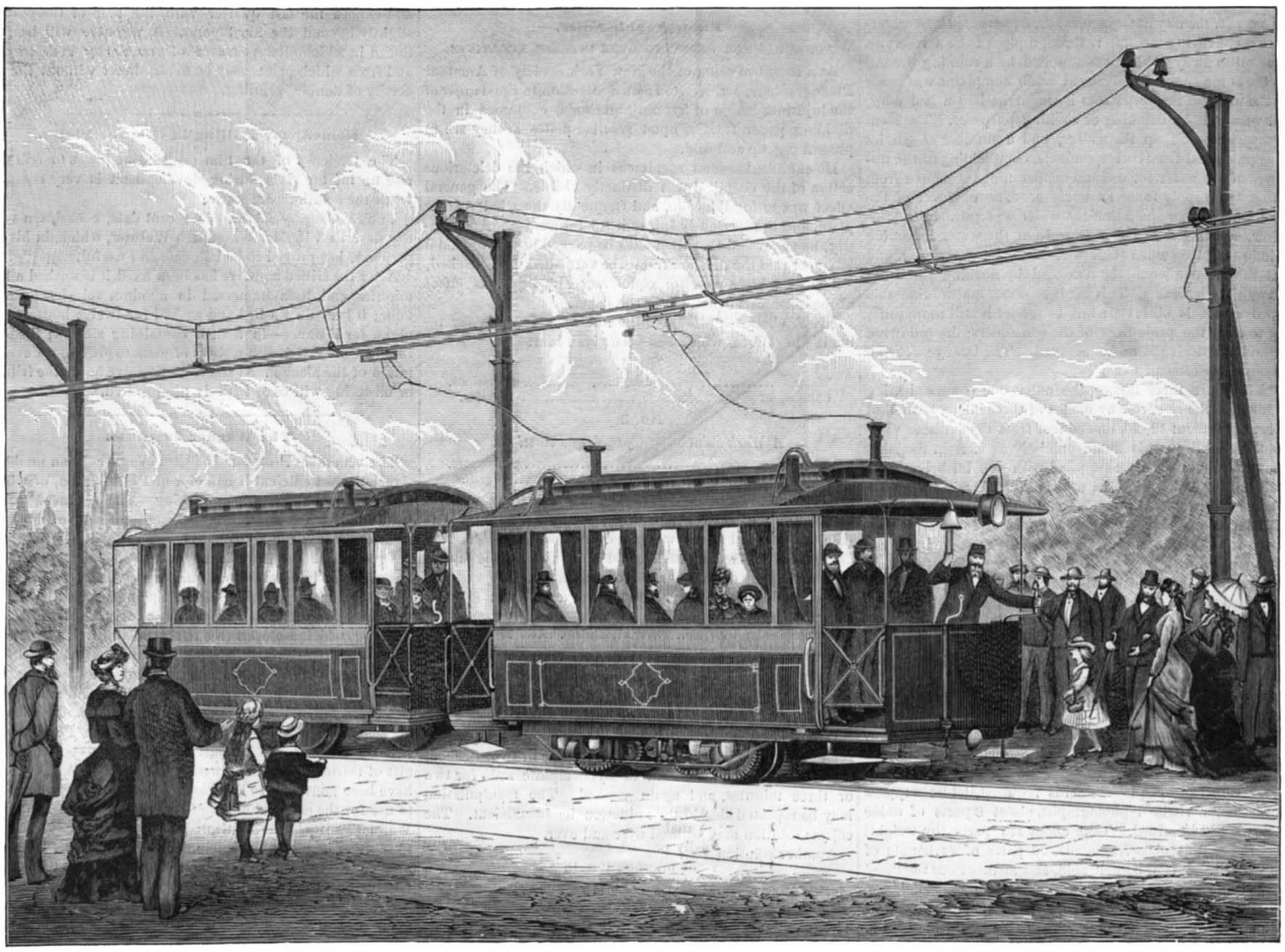
ELECTRIC GENERATOR FOR FRANKFORT RAILWAY.

Stern Wheel Steamer for the Nile.

In addition to the flotilla of river craft which is being constructed by various builders, the British Government have entered into a contract with Messrs. Yarrow and Co., for the immediate supply of a stern wheel steamer for service on the Nile, and she will be shipped in the course of a few days from Woolwich. In design she is like the American stern wheel boats, and resembles Le Stanley, built by the same firm for the Association Internationale for the navigation of the upper waters of the Congo, and which, it may be remembered, was tested on the Thames in the early part of this year with great success, and illustrated in our pages. The steamer just purchased was built for Central America. She is 80 ft. in length by 18 ft. beam, and will have a draught of 16 in. only. She is being shipped in pieces, all of a size suitable for hand porterage, so that she can be sent on to any section of the Upper Nile that may ultimately be decided upon, and there put together and launched. Military authorities, after much consideration, have come to the conclusion that the steamer is the one best suited for overcoming the difficulties incidental to the navigation of the shallow portions of the Nile, and especially for ascending the rapids. In order that there shall be the greatest possible dispatch in riveting up and starting the vessel, a large staff of engineers and shipbuilders from the works of the firm are to accompany the expedition. The steamer will be furnished with an upper and lower deck, and it is estimated that she will be capable of conveying from 400 to 500 soldiers. She will be fitted with several machine guns mounted at a considerable elevation, so as to command an extensive range over the river banks, and, no doubt, she will be found a valuable addition to the expedition.

The Petrified Wood Industry.

The petrified forests near Holbrook, Ari., have been purchased by a company. They have commenced the shipment and manufacture of the petrifactions into tablets, tiles, and various ornamental articles in building and finishing. In this connection the Prescott *Miner* has the following: "Governor Tritle informs us that while in San Francisco he inspected an establishment recently started for the cutting and polishing of petrified wood taken from the wonderful forest of petrifactions existing along the line of the Atlantic and Pacific in this Territory. The parties engaged in this work state that the petrified wood is rapidly driving California onyx from the market as a material for mantels, etc., as it is susceptible of a much finer polish and is also more permanent and lasting than that of the onyx. Several companies have already been formed for the purpose of getting possession of portions of the forest by pre-emption," thus promising to further push the manufacture.



SIEMENS ELECTRIC RAILWAY AT FRANKFORT GERMANY.

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Correspondence.

A Ten Year Old Wood Pavement.

To the Editor of the Scientific American:

SIR: In the SCIENTIFIC AMERICAN for Aug. 16, I notice an article of some length, in relation to the Kerr wood pavement. The description therein given with respect to the process by which it is laid is similar to the process for laying the Flannigan pavement, decidedly the best wood pavement ever laid in Washington.

The Flannigan pavement is laid upon a bed consisting of crushed stone, cement and asphalt; the blocks are round and of cedar, the interstices being filled with gravel and hot tar, the whole being covered with a substantial coat of asphalt and rolled, making it one of the most compact pavements in use. One of these Flannigan pavements was laid in this city on Third Street, adjoining the U. S. Botanical Gardens, and one on Eighty-third Street, S. W., extending from First to Third, in 1874, which, when taken up to give place to the Belgian pavement now being laid, were found to be in a perfect state of preservation, the blocks being as dry as when first laid, and those that were laid in the gutters and along the curb were as dry as any of the rest. This pavement is impervious to water, and is I think equally as good, if not superior to the Kerr pavement.

Very respectfully,

Washington, D. C., Aug. 18, 1884. J. E. BRUCE.

A Sulphur Well at Columbus, Ohio.

To the Editor of the Scientific American:

In recent issues of the SCIENTIFIC AMERICAN I find several articles on artesian wells, which cause me to here give a description of a six inch driven well just completed at the tannery of Schaumaker Bros., of this city, which after going through 60 feet of sand and 36 feet of clay struck bed-rock, into which they penetrated to the depth of 50 feet; there struck a strong stream of sulphur water, which immediately rose to the height of 10 inches above the surface. I have seen two pumps inserted which, combined, throw a 3 inch stream, and with that they succeeded in lowering the water about 14 inches, where it would stop, and after stopping the pumps it would immediately rise to its standing point. This well is by experts pronounced to be finest well of its kind in this State. Scores of people go there daily to drink the water and take it home with them. At present the water is conducted into the tannery; but as some say it possesses great healing power, it is hard to tell what the future will bring.

A. L. SCHEIBLICH.

Columbus, O., Sept. 22, 1884.

The Filtration of Orange, N. J., Water.

Last year the city of Orange, N. J., constructed new waterworks, conveying the water through pipes from a reservoir some miles away, which was supplied by a running stream. As the summer season advanced much complaint was made by the users of the water that it was stale, had a bad odor, and was unfit for drinking or cooking purposes. The local newspapers took up the matter, and a number of articles were published from correspondents, complaining of the unfitness of the water for use and condemning the source from which the supply came as unclean. The engineer of the waterworks maintained that the water was pure at the reservoir, and that the trouble arose from the water becoming stale in the pipes when there was but little water used, and that the trouble would be remedied by flushing the water through the hydrants. This has been done, and considerable improvement is observed; but to render it still more pure, and to allay the prejudices of the consumers; the following method of filtering is to be adopted. The Orange *Journal* thus describes the process:

"There are three flumes, the outer one communicating direct with the reservoir by means of three inlets, located at intervals of about 12, 20, and 30 feet from the surface. The water passes into this flume precisely as it is in the lake. The second flume will be supplied with 400 bushels of fine charcoal, through which the water must all pass, and enters into the third flume through a copper sieve. Both sides of this third flume have a copper sieve about fourteen feet in height from the bottom, and the conduit for supplying the city connects with this. Into this lower part of the flume 200 pounds of sponge will be packed, and thus all the water to be used will be filtered through this charcoal and sponge before it reaches the consumers."

The hints contained above may prove useful to other places where the water seems foul, dead, and unwholesome.

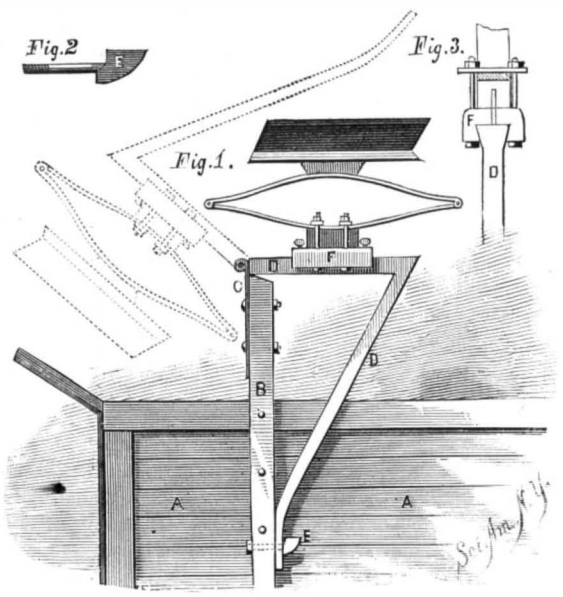
Enamel for Metals.

The following is said to form a good enamel for cast iron, wrought iron, or steel, and we are informed that it will not crack on being subjected to moderate changes of temperature. When an opaque enamel is required, let us suppose as a basis for vitrified photographs, about 8 parts of oxide of tin should be added. Take about 125 parts (by weight) of ordinary flint glass fragments, 20 parts of carbonate of soda, and 12 parts of boracic acid, and melt. Pour the fused mass out on some cold surface, as of stone or metal, and pulverize when cooled off. Make a mixture of this powder with silicate of soda of 50° B. With this coat the metal to be glazed, and heat in a muffle or other furnace until it is fused.

WAGON SEAT.

Bolted firmly to the side of the wagon body is a post, B, to the upper end of which is hinged the horizontal bar of the bracket, D, supporting the seat. The rear inclined brace is rigidly secured at its upper end, and is slotted at the lower end to enable it to pass over a key, E, held to the post by a nut. The brace locks behind a shoulder formed at the upper edge of the head of the key, which may be more surely prevented from turning by having its lower shoulder mortised in the face of the post. The seat is mounted upon a suitable spring fastened by bolts to a sliding block, F, between which and the spring is a wooden block. Each sliding block—a similar device is placed at the other side of the body—is fitted to slide back and forth upon the upper bar of the bracket (as shown in the cross section, Fig. 3), and is held in any position by one or more set screws.

To throw the seat forward, as indicated by the dotted lines, it is lifted at the back until the upper ends of the slots can pass over the shoulders of the keys, when it may be swung over as indicated by the dotted lines. In swinging the seat back into position for use the slots will pass over the heads of the keys, and a little greater down swing of the seat will cause the ends of the slots to fall, and lock behind



MILLER'S WAGON SEAT.

the shoulders. By removing the hinge pins the seat and brackets may be lifted from the wagon.

This invention has been patented by Mr. Alonzo Miller, of North Adams, Mass.

Photographic Notes.

FORMULAS FOR REDUCING OVER-INTENSE NEGATIVES.

At a recent meeting of the New York Society of Amateur Photographers, Mr. Newton called attention to the danger of the injurious action of hyposulphite soda, contained in the dividing paper frames, upon gelatine plates as they are at present put up and sold.

He exhibited several specimens in which the deleterious action of the chemical was distinctly visible. The general effect was to fog the edge, and frequently the whole of the plate, and thus seriously injure it for future use. As a remedy, he suggested that the plates be packed in tin or metal boxes, or that the division frames be varnished or shellacked, which would in a measure counteract any injurious effect of the chemicals contained in the paper.

Mr. F. C. Beach presented the following formula for reducing negatives, which had been given him:

No. 1.

Water	15 drachms.
Chloride of gold	15 grains.

No. 2.

A Weak Solution of Cyanide of Potassium.

Water	8 ounces.
Cyanide of potassium	10 grains.

The plate to be reduced is soaked in water for a minute, and is then flowed over with No. 1 for half a minute; it is then washed, and flowed with the cyanide solution. The reduction takes place gradually, and if the first application is insufficient, the operation should be repeated.

A formula given by Mr. Newton was as follows:

Water	10 ounces.
Sulphate of copper	100 grains.

After the copper is dissolved:

Bromide of potassium	100 grains

are added, which converts the solution into bromide of copper.

One ounce of the above is added to two ounces of water; the plate is then soaked in this for a minute or two, washed, and put into a weak solution of hyposulphite soda for two or three minutes, and again washed. The manipulation may be repeated should the reduction be insufficient. The copper solution may be used over and over.

Another solution was:

Water	1 ounce.
Perchloride of iron solution, as obtained at the druggists'	½ drachm.

The plate is laid in this for two or three minutes, washed, put into a weak solution of hypo for the same length of time, washed, and dried.

A formula given by Dr. Janeway consisted in dissolving 9 grains of ferrid-cyanide of potassium (red prussiate of potash), by stirring with a glass rod, in 3 ounces of a 5 per cent solution of hyposulphite of soda, which is sufficient to cover a 5 x 8 plate, and should be mixed on the day it is used.

The action of the reducer is quick, and careful watching is necessary. With a camel's hair brush, which has been dipped in the solution, dense portions of a dry negative may be touched over and reduced. Care should be taken to wash off the plate after each application.

How to Photograph Paper Photographs.

In copying paper photographs the granular texture of the paper invariably injures the copy, making it appear to be covered with whitish dots.

A method practiced by Mr. Denier, a Russian photographer, says the *British Journal of Photography*, enables one to obtain a perfect copy in which all granularity is avoided.

On copying the original it was illuminated with a strong side light, so as to minimize the grain as much as possible to begin with. The negative was made tolerably vigorous, and then slightly retouched. In printing (using a registering printing frame), when the impression had attained somewhat about half its proper depth, it was removed from the negative, and a couple of thin films of gelatine—such as those used in packeting confectionery—were placed upon it, one of those films being tinted a pale blue, and the other colorless. The half printed sheet was next replaced over the gelatine sheets in exactly the same position as it previously occupied, and the printing continued until it was dark enough. By this method the details are printed first, while the second printing blurs and softens the picture, and prints out the granularity. An ordinary printing frame may be converted into a registering frame by placing a piece of sheet glass in the front, and laying upon the negative, which must have one corner and two sides abut against the interior sides of the frame. The other edges of the plate should be wedged between the sides of the frame. The negative being rigidly secured, the paper must be cut so that its top and one side, at least, shall form exactly a right angle. In replacing the paper in the frame, if care is taken that the two edges accurately fit the corner of the frame, it may be removed, the films inserted, and the paper again replaced, provided that the same edges strike the sides of the frame, without interfering with the result or overblurring the picture. Very soft and peculiar effects may be produced by this process.

Another method is to place the photograph in a strong side light, and in making half the time of exposure with the image exactly in focus on the ground glass, then capping the lens and moving the back of the camera slightly within the focal point, so that the image will be a little out of focus; then to expose one quarter of the time, recap the lens, and expose the last quarter with the rear of the camera slightly beyond the focal point. A negative will be produced in which all appearance of granularity is destroyed, and from which prints may be made direct without the necessity of double printing.

Remedy for Frilling in Gelatine Plates.

The tendency of the film on gelatine plates to frill and rise up off the glass during development is very common when the solutions are warm.

The *Br. Jour. of Photo.*, of a recent date, contains a remedy described by Mr. Watmough Webster, which, in his experience, has proved to be valuable and useful.

After the frilled negative has been fixed it is washed a few minutes, and then immersed in an alum solution for one hour; it is again washed and soaked for twelve hours—over night, for instance—in a dish containing alcohol; the dish should be covered with a sheet of glass to prevent the evaporation of the alcohol. At the end of twelve hours the frilling or blistering will have entirely disappeared.

The Wagner Institute.

The venerable Professor William Wagner is an unobtrusive but most efficient benefactor of Philadelphia, of whom many citizens know little or nothing. The Wagner Free Institute of Science is an establishment entirely of his own creation, which for many years has been doing inestimable good in the northwestern part of the city. There he has collected in commodious buildings a library, collections of natural history, philosophical apparatus, and many of the most costly and useful features of a great institution of learning, which are open free to the public; while lectures—also free—are delivered by scientific men every fall, winter, and spring, which are attended by thousands of young people whose means do not permit them to procure education elsewhere. Professor Wagner has founded and endowed his Institute liberally, and according to the Philadelphia *Evening Bulletin*, he has just added to the endowment a gift of thirteen fine new dwellings, costing $165,000, which have been conveyed to the trustees, who will have the rental to use for the establishment. The whole value of Professor Wagner's gifts to the Institute is over $600,000. It is safe to say that no other Philadelphian has, during his lifetime, been so wisely generous to the public as Professor Wagner. His Institute was founded about thirty years ago, and he has reached the great age of ninety-two years. But he still takes an active interest and pride in his work, and it is hoped that he will live long to enjoy it and to render it still more efficient.

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THE FISH RIVER CAVES, NEAR SYDNEY, AUSTRALIA.

BY J. E. RICHTER.

These caves are situated about 80 miles west of Sydney, Australia, and are some 3,000 feet above sea level, in an interesting mountainous locality. They were first discovered by a party of settlers in 1866, while in pursuit of bush-rangers.

Apart from the cave sights, that attract so many visitors, the locality surrounding affords an interesting study to the geologist and student of nature. A wall or ridge of limestone, hard as flint, and several hundred feet in height, stretches across country for several miles, sometimes as a ridge, at other places as an arch or bridge spanning streams. One of these creeks, containing a stream measuring several square feet in section, disappears under the limestone, embouching again a mile or so further down. Its subterranean course has never yet been traced. Contiguous to its course, little doubt exists of many undiscovered caves, possibly surpassing in beauty those at present shown to delighted visitors. In ages past this ridge of limestone, now so high above the sea, and 80 miles from it, was the bottom of the warm ocean, the abode and regenerative ground of the myriad tribe of shell fish. Unearthing a detached piece of limestone at grass from the red soil, different forms of shell are discernible over the surface of it, a substance in the soil eating or corroding certain parts of the limestone more than others, leaving the shell forms raised above the surface of it. Viewing these forms, it is significant that none of the shells originally forming a part substance of this limestone were larger than 1½ inches in any section. The line of junction of the limestone with other rocks is visible at several places. On the western side an indurated Silurian schist formation closes in upon it. At the other, softer schists. Another creek, after having worn out a passage for itself through this wall of limestone, immediately joins the stream aforementioned; and it is near the junction of these streams the caves are situated, so far discovered, and as shown to the visitor by the caretaker--the caves having been wisely reserved by the government of New South Wales from any private proprietary speculation or interference. Where these streams have bored a passage through several hundred yards of this wall of limestones, traces are left sufficiently numerous to show that said streams had originally worked through at a much higher level; in after ages grinding deeper to the present bed.

These caves are singularly attractive. The intricate galleries, halls, and passages in their subterranean scenes are so truly magnificent that a person having once seen them is desirous of viewing them again and again, new features being presented to his view at each visit and at every turn. The strange forms that have been assumed by the drippings from the limestone are almost infinite, and are in beauty unsurpassable in their own character elsewhere. When lighted up by the incandescent magnesium wire or other strong light, these sublime chambers, so strangely formed by nature's hands, present a gorgeous spectacle, filled as they are with drooping sprays, coral growths, delicate pendants, gigantic columns, handsome shawls, huge curtains, and shadowy arches of the most fantastic kind. There is a good coach road from the railway at Tarana to the caves, 36 miles.

The cavernous limestone of the Fish River is bluish-brown in color, compact, and hard; fractures easily under the hammer, leaving an edge sharp as that of flint. It is capable of taking a high polish, almost equal to that of the New Zealand greenstone, so much used in jewelry ornamentation at the present time in Australasia. At different places about the caves, where the configuration of the surface has forced the many animals of the kangaroo species, large and small, to travel on any narrow trail, the limestone is worn so smooth and polished by the feet of these indigenous animals that the face of the visualist is reflected to him as in a mirror at favorable spots.

The length of the numerous caves in their various turns and curves, ascents and descents, would probably measure several miles, taking about three days to view, while the student may spend three days more to advantage inspecting the many strange overground features of the neighborhood, including the unique surrounding woodland scenery, typically Australian.

The fissured condition of some of the limestone in this locality is due to volcanic upheaval disturbance. Many of the smaller fissures have been filled since the upheaval by silicates and spar, some colored, denoting the presence of oxides of iron and probably other metals, from which also the hard carbonates deposited in such lovely and various forms on the walls, or dependent from the domes and arches of the caves below, have obtained their variegated and diversified colors. Some of these silicates present an example of that rare combination, stratification and crystallization.

For two or three years after discovery the more accessible caves were partly despoiled by iconoclastic inclined visitors breaking away the best stalactites and carrying them off to adorn their homes. Then the government assumed charge of these marvels of nature, since which time the caves are locked at their various entrances by iron gates, and can now only be seen by the guidance of the caretaker, whose service is free of charge, the material for displaying light and cost of sustenance while there being the only charges made. Much improvement has been and is being made throughout to enable visitors, including ladies, to better see the many wondrous sights without the physical exertion that was necessary in former years.

Trenches have been dug in many places, so that one can now walk along upright where once it was necessary to crawl along on hands and knees, or wriggle along, caterpillar fashion, through passages that measured but 10 or 12 inches from floor to roof. Bridges have been thrown across chasms and pools, wire ladders and stairs have been fixed at difficult ascents or descents, iron or wire rope railing guards the more dangerous side lines and pits, and rocks and other obstructions have been cleared away.

It would be difficult, as it would be unwise, to compare these caves with the Mammoth Caves of Kentucky or the more recently discovered Luray Caves of Virginia, each having its own characteristics—the Mammoth, for their vastness and rosette covered walls; the Luray, for their tessellar pendent features; the Fish River, for their spiked and filigree glasswork and shawl-draped roofs and walls.

The student of nature, accustomed to find the most exquisite symmetry, form, and color where light and warmth are in most abundance, is surprised to find here, as in other caverns, that the most charming forms, figures, and colors have been slowly created in these underground corridors, in a temperature not more than 60° F., and in darkness as intense as that of some parts of the Black Tartarus, as believed in by the ancients. This silent, enduring evidence rather upsets the assertions of those theorists who assert that the richest colors are not producible except by the aid of light or heat, or both conjointly.

In some of these caves we were often confronted by what at first sight has the appearance of the filigree work of the glassblower, as if a member of that craft had traversed with a portable apparatus, and had in a haphazard fashion practiced his art here and there in the most whimsical places, on walls, stalactites, in niches, on arch under one's feet, and on dome 50 feet above.

In some places our attention was attracted to side floors apparently thickly strewn with potatoes or turnips, covered by a half inch of what appeared newly fallen snow. It is not snow, but a soft fungus or down closely resembling it; and, unlike a few minutes' fall of snow, is the gradual growth or decay of ages, no doubt the product of disintegrated carbonates, the potatoes being concretionary nodules, probably formed from the same substance. Near these and at other places the walls present the appearance of an irregular patchy Beton concrete work, or the whitewashed dab plastering to be met with on the outside walls of the houses of the German peasant—at other places as if boys had been throwing small snowballs at the walls, which had stuck there, white as snow, a portion of it as soft too.

As illustrating the indestructibility of matter, the limestone, extremely hard though it be, wastes away in the presence of aqueously saturated air, and under certain conditions on contact with water, and is deposited at lower levels in all those strange and curious forms that so exult visitors.

The caves that have their entrance from outside are but four or five in number: The Elder Cave, Nettle Cave, Lurline Cave, Lucas Cave. The Imperial Cave, the finest of all the number, was discovered but two years ago. All other caves are but sub-caves of these. The Lucas Cave is singular in its form, winding downward as it does until, at its further end, we find ourselves directly under the entrance portion, but 200 feet lower.

Let us pause a little, and think over the evidently extraordinary slow growth of that grotto of stalactites before us. From long continued observation, extending over a century, in the limestone caves of Europe and America, the results go to show that it takes a thousand years to make a foot in length of the slowest forming stalactites. It is equally certain, however, from the results of observations in the same caves, that the same length has become aggregated in 100 or 200 years, but the conditions under which each were formed being different. From one falls a drop of water but once in two or three minutes, much of the water previous to its falling as a drop being evaporated on its coming in contact with air or a current of air. From the other the water falls in an almost continual trickle. At the Fish River Caves the only observation as yet taken was by the guide, who informed us that, at the entrance to the cave, and previous to the path being lowered, he had accidentally broken the tip off a stalactite 8 inches long by striking it with his head sixteen years ago. The new growth, the growth of sixteen years, was but ⅜ of an inch in length by ⅛ in thickness, the thickness of the stem where broken off being about ⅜ of an inch. At the time of our visit, one to two minutes elapsed between the falling of each drop of water from it. At this rate it must have taken 360 years to form this stalactite of 8 inches length previous to its breakage.

At one place, measuring about 150 square feet, we counted 36 stalactites to the square foot, from an inch to fifteen inches long, making about 5,000 delicate pendants in this sequestered nook. The longest stalactite noted in these caves was about 20 feet or less, and the tallest stalagmite about 10 feet, many of the latter assuming most peculiar shapes, as of human-like figures, hooded monk and nuns, of robed statues and statuettes, of fish standing on their heads or tails, of candlesticks, as in Fig. 2, to the right in Nelly's Grotto.

Throughout our subterranean travels, numbers of pools and basins from 4 inches to 20 feet in diameter, filled with water as clear as the distilled element, continually met our view, and in the strangest and most unexpected of places too; on top of a mound, on shelves or ledges, on terraces, or in niches, while in vicinity of Fig. 6 is a sheet of water usually less than 6 inches in depth, 100 feet long, its bottom glistening with pearls and other concretionary forms like nodules, marbles, birds' eggs, etc., interspersed with patches of diminutive coral forms, a sight so dazzling to the eye that if continued becomes almost painful.

The Shawl Cave, Fig. 5, nature has devoted to the display of shawls, and there are curtains from 10 to 20 feet long, ¼ to ½ inch thick, and 2 to 5 feet wide. Some are nearly white, while others are more or less beautifully striated in white, pink, yellow, and brown, like the markings visible in agates and other precious stones. A light placed behind these curtains reveals some to be opaque, others translucent, and all extremely handsome. A tiny stream of water trickles down the edge of each shawl.

The Crystal Salt Pans, Fig. 6, are a number of shallow basins filled with beautiful semicircular sheets of gleaming water (basins dry when photographed), each basin being a terrace, and catching the overflow of water from the one above it. It was only after a second investigation that we could realize that the ruffled margins and corrugated brims to these calcareous pools were built up by deposition of material contained in the water itself, the deposit strangely taking place only at the point of overflow. These basins are sometimes dry, when they present the appearance of a number of evaporated salt pans at a salt factory, the bottoms of the basins being then covered with shining crystals. Viewing the pillars to the left reminds the visitor of the ruined monumental columns met with in Italy, Palestine, or Greece.

Fig. 1, Lolly Cave, is an overcrowded curiosity shop, the most splendid gems hidden from view by inferior articles.

Nelly's Grotto, Fig. 2, is an assemblage needing no comment.

Solidified or petrified cascades and waterfalls are numerous throughout the caves. A few are spotless white in color, others leaden blue, some striated in various shades of white, pink, and yellow, while more are of a transparent black or brown. The latter is also the prevailing color about the diamond wells, where the carbonates are coated with a surface of crystals, the crystals being large.

Dr. Schliemann's Archæological Discoveries.

"We may communicate," says the *Academy*, "a few more details in regard to Dr. Schliemann's important discoveries at Tiryns. The walls of the prehistoric palace he has disinterred there are formed of limestone and clay; the latter has been turned into brick by the action of fire, while the stone has been burned into lime. In some places the surface of the walls had been coated with stucco, on which traces of painting can still be observed. The colors used in these paintings are black, red, blue, yellow, and white; and Prof. Virchow has pointed out that the blue is composed of pulverized glass mixed with copper, but without cobalt. One of the paintings represents the same pattern as that found on the roof of the *thalamos* attached to the Treasury of Minyas at Orchomenos. Another depicts a man riding on an ox, whose tail he holds. The artist has made three attempts to draw the tail, and has forgotten to obliterate the two unsuccessful ones. The paintings have been carefully removed and sent to Athens. Among the ruins of the palace twenty-seven bases of limestone columns have been discovered, but no drums, besides a sandstone capital in the old Doric style. The chambers of the building were full of objects of all kinds, including pottery, obsidian knives, rude hammers of diorite, and grapestones. No iron has been met with, and but little metal of any sort, though lead is relatively plentiful. All traces of writing are equally absent. The pottery resembles that of Mykenæ, but the presence of obsidian and the scarcity of metal imply that Tiryns was the older city of the two. As has already been observed in the *Academy*, the scale and arrangement of the newly found palace, with the two temples within it, are almost identical with those of the palace and two temples discovered in the second prehistoric city of Hissarlik."

Painting Tin Roofs.

Tin on a house top should be well painted once in four years. For roofs, light, cool colors are preferable, because they reflect the warm rays of light, and thereby lessen the expansion and contraction of the metal and the shrinking of the boards underneath, and so lessen the liability of the tin to crack in the seams. The temperature of attic rooms in summer will be materially lower if the roof be painted with a light rather than with a dark color. The writer has learned from long experience that the finest French ocher is the most economical pigment that can be used for that purpose. If, as is sometimes the case in country houses, where the roof is a conspicuous object in the architecture of the building, a dark color be indispensable, the use of pure Venetian red darkened with lampblack is recommended as the most durable and economical. If by some process the oil used in roof painting could be prevented from becoming hard and brittle, it would be a great gain. The poorest oil paint, however, is better than neglect; and the best economy consists in keeping tin entirely and thoroughly protected from the corroding influence of dampness. Old paint, which has become "fatty" from exposure to the atmosphere, is better than new for roof painting. Not a drop of turpentine should be used for such work.—*The Metal Worker.*

SIR FREDERICK PELGRAVE BARLEE, Governor of the British island of Trinidad, and a distinguished man of science, died recently. His valuable services in promoting the prosperity of Belize, Honduras, are well known.

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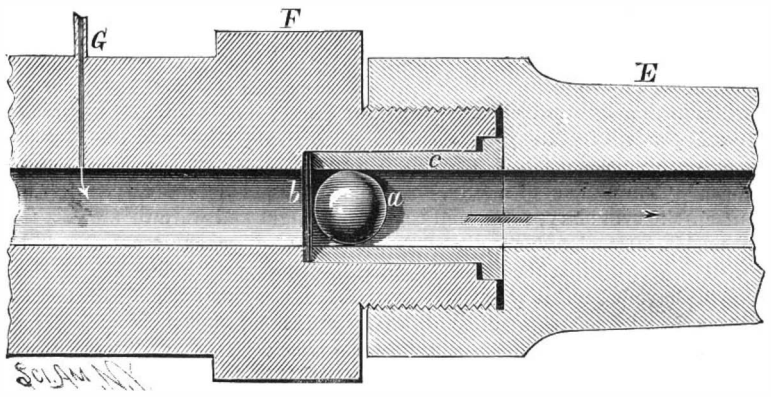
THE KEELY MOTOR DECEPTION.

Another chapter in the history of this time-worn, stock-jobbing deception was lately completed by a public exhibition at Sandy Hook, N. Y., on Sept. 20, of a pretended "etheric force" gun; but which in reality, to our eye, was nothing more than a clumsy air gun, from which a few bullets were discharged. Keely was present and performed as a juggler, much to the satisfaction of the assembled crowd of New York stock brokers, who seemed to relish the Keely jargon and the muddy clarity of his absurd explanations.

In brief, Keely and his assistants brought to the ground a small air gun, shown in our engravings, with a cylinder charged with compressed air. The cylinder was connected by a small pipe with the breech of the gun; thin disks of hard and soft rubber formed a partition between the breech air chamber and the bullet. The performance consisted first in the turning of the air faucet by Keely, then while the air was flowing through the small pipe into the air chamber, he struck on the rear part of the gun with a mallet, by which he pretended to vibrate the "etheric vapor." By the time he got through with this juggle the air pressure had accumulated behind the disks sufficiently to burst them, and then the bullet was driven out; Keely then turned off the air, and prepared another charge. By varying the thickness of the disks the velocity of the bullets could be increased or diminished as desired to suit the credulity of the audience; and by this juggle it was pretended that the pressure of the "etheric force" increased with the discharging of the gun. The day following the "exhibition" the daily papers contained laudations of Keely's "great success," the stock of the "Keely Motor Company" was thereby sent up from 9 cents on a dollar to 15 cents, and the money of the deluded purchasers was thus successfully netted.

The following is an account of the apparatus and mode of working, as described and performed on this occasion by the Keely operators. The force is derived from an etheric vapor generated by machinery specially designed for the purpose; this inter-atomic ether is composed primarily of water and air mixed in the proportion of half a wine glass of water to a bucketful of air. When this mixture is placed in the generator; which is located in the inner recesses of Mr. Keely's shop in Philadelphia, it is subjected to the influence of certain vibratory impulses which "negatize" the chemical affinity binding the elements together and a disruption ensues.

Mr. Keely has discovered that sound not only annihilates atomic force, but it also subdivides the atoms themselves; and hence, although water has yielded only pure oxygen and hydrogen when dissociated under the direction of ordinary physicists who have been unable to change the ratio existing between a volume of water and the resulting volume of gases, he has been enabled to fill large spaces with vapor under great pressure, simply because under his manipulation our atoms become his molecules. Incidentally it may be stated that he claims to have obtained a vacuum of thirty-one pounds. The gun has a spherical knob, secured to the breech, from which projected a round bar having a diameter about equal to that at the extremity of the muzzle. The breech was 4½ inches in diameter, and the length 3½ feet. Just forward of the trunnions, at the point F, the muzzle unscrewed; this construction was necessary to permit the placing of the gas check in position. The sectional view of the gun is not drawn to scale, and was not extended to the end of the breech, as the inventor did not wish to make public all the details; we give the drawing merely to show how the gas check was secured and its location. A sleeve, *c*, having a bore equal to that of the gun fitted in an annular recess in the forward part of the breech, F. As the muzzle was screwed upon, the sleeve was forced in until it firmly held the gas check placed between the rear end of the sleeve and a shoulder formed in the breech.

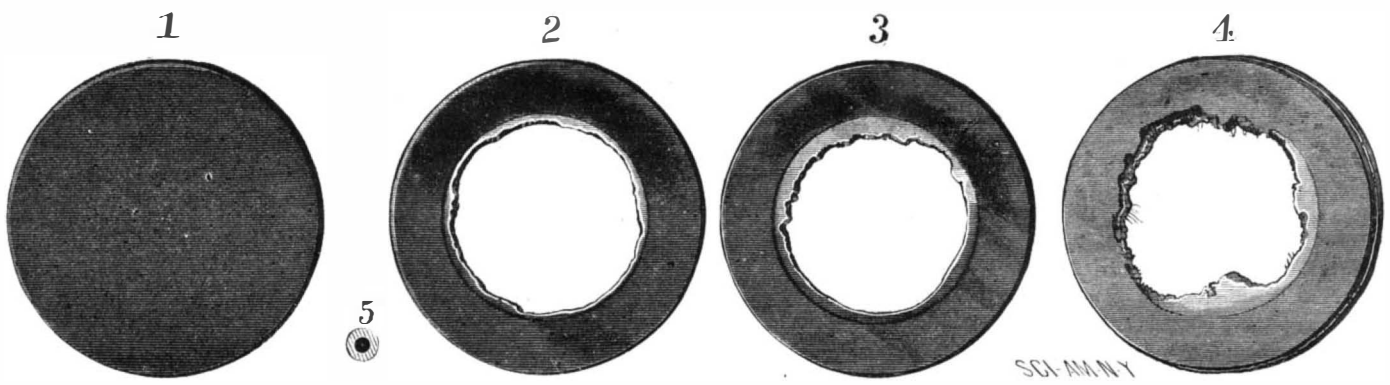


KEELY GUN.—LONGITUDINAL SECTION.

The gas check consisted of three disks having a diameter of 1⅝ inch; the two front disks were of common hard rubber having a thickness of $\frac{1}{32}$ of an inch; the third disk—placed next to the pressure—was of soft rubber packing, single ply and $\frac{1}{16}$ of an inch thick. The exact size of these disks is shown in Figs. 1, 2, 3, and 4, Fig. 1 being the disk before rupture, Figs. 2 and 3 showing the hard rubber disks after the discharge, and Fig. 4 showing the soft rubber one after the discharge. The broken disks also show the imprint made by the end of the sleeve. A spherical lead bullet having a diameter of 1⅛ inch was used, the bore of the gun being just sufficient to insure a snug fit. Vapor was admitted through the opening, G, to a chamber, behind the packing, having a capacity of one-half pint.

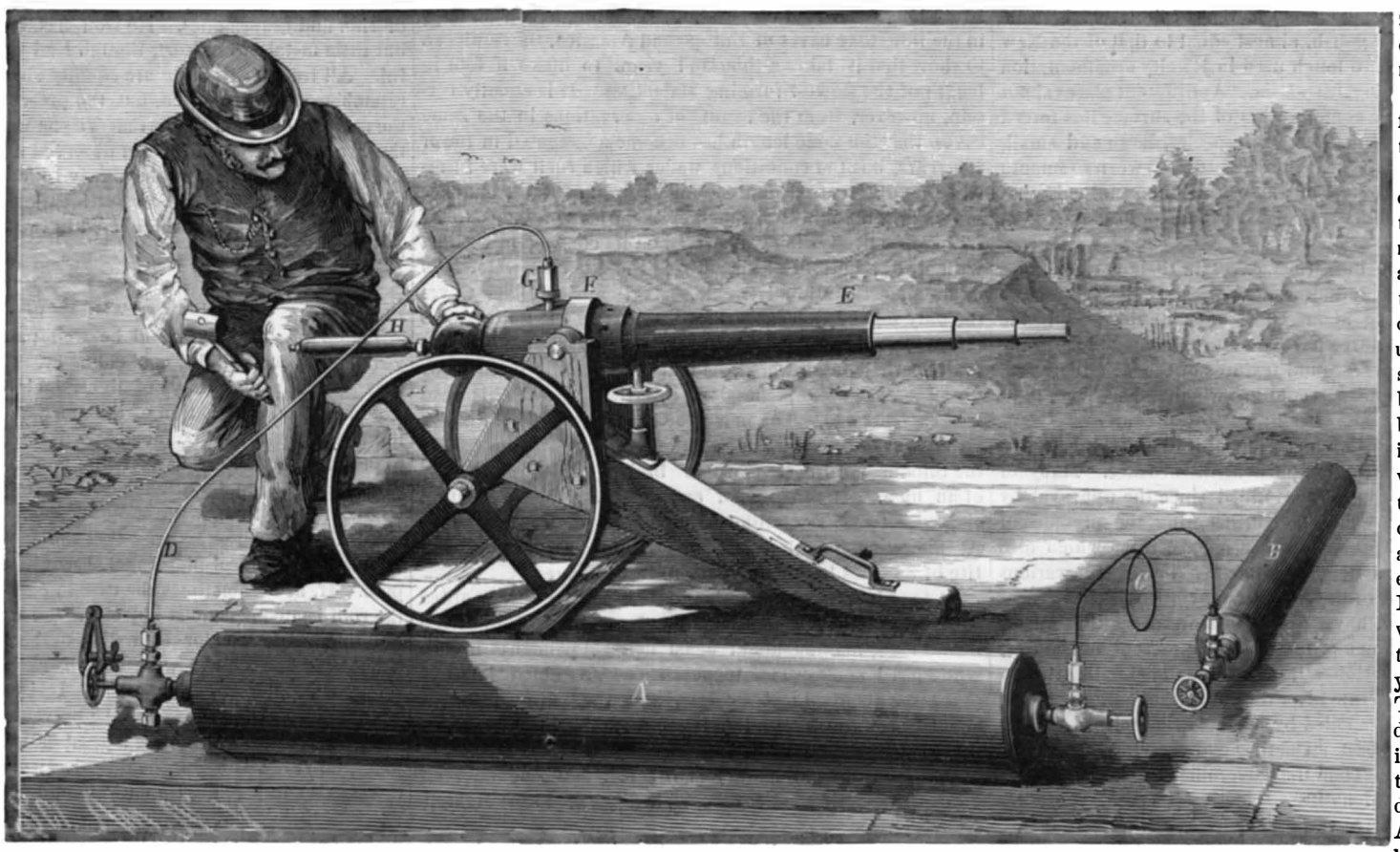
A copper tube, $\frac{3}{16}$ of an inch external diameter and $\frac{1}{16}$ of an inch internal (Fig. 5 being a cross section, full size) led from the breech, G, of the gun to the magazine, A, which was made of wrought iron, and was 4½ feet long, 8½ inches outside diameter, and has a bore 5 inches in diameter; the capacity was 5 gallons. This magazine was connected by the wire, C, to a second one, B, similarly made, but only about half the size. The supply from the small to the large magazine was controlled by valves, as shown, and a valve governed the supply to the gun. These magazines had been charged with the inter-atomic ether evolved by the generator heretofore alluded to as being in Mr. Keely's shop, and although grave doubts had been expressed as to the propriety of transporting them upon the railroad—owing to the uncertainty of the effect that would be produced upon the vapor by the sonorific qualities of an express train—they arrived safely at the range. When the valve of the first magazine was opened nothing could be obtained from it (this was a preliminary part of the trial, and took place before the arrival of the guests), and it was feared that the vapor had become "negatized," but it was soon "revivified" by a few scientifically administered blows carefully distributed between the big and the little magazine.

It may be here mentioned that a wooden mallet which Mr. Keely held in his hand produced effects which it is doubtful if the magician's wand could even equal. A stroke upon the little magazine "intensified" the qualities of the other in which the "vivification" was kept up by a blow now and then delivered, and a slight tap upon the end of the "resonator," H, exploded the vapor in the breech and discharged the gun. So we see that the "vitalization" of the entire plant depended very materially upon the judicious use of a mallet.



KEELY GUN.—FULL SIZE VIEW OF GAS CHECK DISKS AND CONNECTING TUBE.

In loading the gun the gas check was first placed in position and the muzzle screwed up tight, when the ball was introduced at the muzzle and rammed home. The valve was then turned, to admit the vapor to the breech, and after waiting a few seconds the end of the "vibrator," H, was struck, when the charge exploded. The time intervening between the turning of the valve and the discharge was, on an average, about six seconds. The first blow upon the vibrator did not often cause the explosion; it was necessary to strike it several times, but, as luck would have it, the blows always preceded the discharge. Mr. Keely did not wait a minute or two in order to convince skeptics that no explosion would take place until he struck the vibrator. There was no appliance of any kind by which the pressure in either the magazines or gun could be determined.



THE KEELY DECEPTION.—THE VAPORIC GUN.

We believe we forgot to mention that the gun itself received considerable attention from the mallet. It had acoustic properties peculiarly its own, and blows upon its exterior set in action "vibrators" distributed through its breech. There were also vibrators forming part of the interior arrangement of each magazine. Nineteen rounds were fired at a target placed 500 yards distant. There was no difficulty in sending the bullets that far with a 5 degree elevation. A conical steel bullet pierced four inches of pine plank placed a few feet from the gun. The noise closely resembled that caused by a common shot gun when loose powder, having no ramming on top of it, is exploded. A small cloud of white vapor, which almost instantly disappeared, followed the discharge. It was impossible to

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detect, with the hand, any change in the temperature of the gun.

The velocities of three consecutive shots were measured. The tenth bullet traveled at the rate of 482 feet per second, the eleventh 492 feet, and the twelfth 523 feet per second.

After the last shot had been fired the tube was disconnected from the gear, and, the valve at the magazine being opened, the visitors were allowed to examine the inter-atomic ether as it issued from the pipe.

It had but a trace of odor, no taste, and had no effect upon the lungs. This ended the trial.

We saw nothing done by the Keely Vaporic Gun which cannot be duplicated by the aid of compressed air.

A gas check made of the same material Mr. Keely used and held in the same way is strong enough to withstand air at a pressure amply sufficient to drive a bullet with the velocity he obtained.

At the lowest calculation and allowing a wide margin for safety, his reservoirs would hold air at a pressure of 20,000 pounds to the square inch; this quantity would be sufficient to fire twice nineteen rounds, and since the thickness of the gas check would govern the velocity of the ball, the last shot would have a velocity equal to the first. Many more than nineteen shots could be thrown by the aid of the same apparatus he used, substituting air for inter-atomic ether.

We estimate that Keely used an air pressure of 800 to 1,000 pounds to the square inch to break his gas checks and discharge the bullets.

Although when new inventions appear it may be necessary to coin appropriate terms, we should not think it essential to resort to a heterogeneous commingle-ment of absurdities.

Furniture Woods.

A generation or more ago the most admired wood for furniture purposes was mahogany. Until quite recently the taste for mahogany has been held in abeyance, and black walnut has long reigned the king of the furniture woods. Before mahogany controlled the popular desire, cherry was a favorite, and our white walnut or hickory was used to a considerable extent. These old fashioned woods are coming into favor again, and very fine effects are produced by the contrasts of cherry and hickory, and by mahogany and hickory. Mahogany and cherry blend admirably as shades of color instead of contrasts. The so called "branch" mahogany, that in veneers on the fronts of bureaus and in the frames of mirrors formerly produced such impossible effects of grain, has given place to that of plain straight grain, the effect of color rather than of grain being desired.

Except yellow and black birch and the satin and birdseye maple, there are few of our native woods that show a very distinctive grain. This makes them valuable as foils to the more erratic grained woods of the tropics. One of these, the *coco bolo*, of a deep red color, with broad striated grain, works up beautifully with the cherry, making a complement of tints, or with the hickory, showing a contrast of color and of grain.

According to the statement of a prominent dealer in furniture woods, our cherry and hickory are coming rapidly into demand, and for foreign woods the mahogany and the comparatively little known *coco bolo* are much called for by makers of fine furniture, carvers, and internal finishers.

John W. Garrett.

John W. Garrett, President of the Baltimore and Ohio Railroad since 1858, died in Baltimore, Sept. 26, in the 65th year of his age. He was born in Baltimore, graduated from Lafayette College, entered his father's banking house at the age of 19, and was made president of the great railroad with which his name has since been associated at the instance of Mr. Johns Hopkins. From that time the road has regularly paid dividends, and the stock has advanced from $57 to something over $200 per share, largely due to his enterprising and energetic management and constant personal supervision, under which the road has been extended and branches built to make it one of the main trunk lines of the country. Mr. Garrett was also during this period the head of his banking house, was one of the trustees of the Johns Hopkins estate, and connected with many other local institutions.

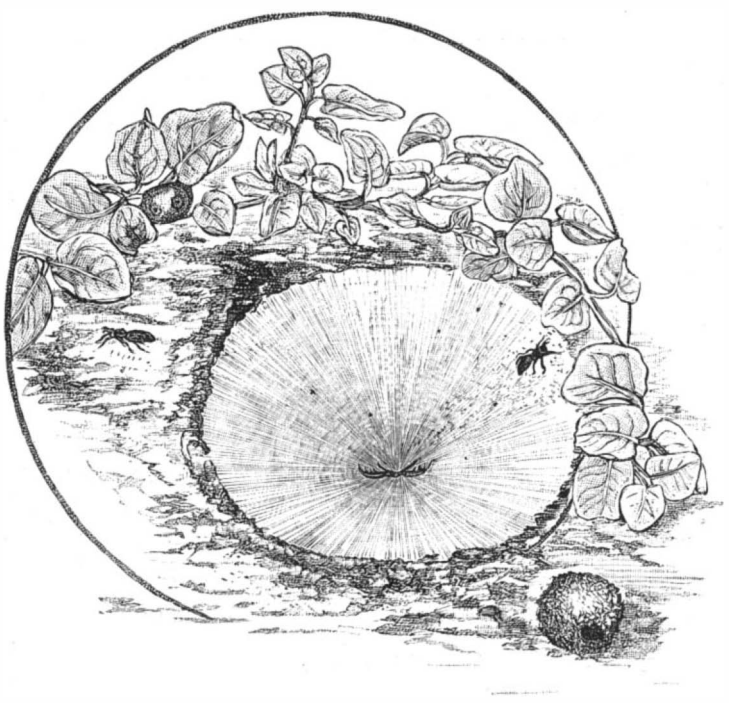
Snow Water Impurities.

Under the heading of "The Beautiful Snow," the *Microscope* points out the kind of organic impurities found in snow, which, added to what we recently quoted on the same subject, very conclusively shows the fallacy of the idea that melted snow forms a good substitute for distilled water. The impurities are as follows: Living infusoria and algæ, bacilli and micrococci, mites, diatoms, and great numbers of fungi spores; also fibers of wood, mouse hairs, pieces of butterfly wings, skin of larvæ of insects, cotton fibers, pieces of grass, epidermis, pollen grains, rye and potato flour, grains of quartz, minute pieces of roofing tile, and bits of iron and coal!

THE ANT LION.

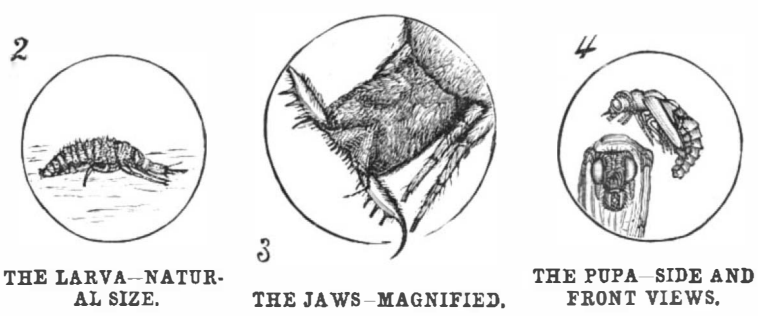
BY H. C. HOVEY.

Although the peculiar habits of the ant lion (*Myrmeleon*) have been repeatedly described by naturalists, many persons do not yet seem to be aware of his existence. Hence it may be worth while to lay before the general reader some of the facts that have been gathered, partly by inquiry, but chiefly as the result of my own observations.



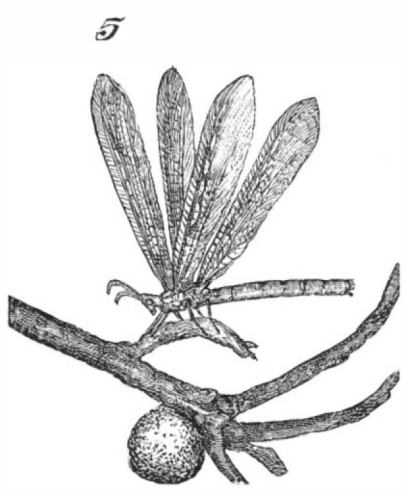
THE PIT OF MYRMELEON, WITH A COCOON NEAR THE MARGIN.

In quiet nooks, where the soil is dry and sandy, and especially in the hollows left by the roots of decayed and fallen trees, the chosen resort of busy colonies of ants, one may have noticed conical pits, from half an inch to two inches in diameter. Each of these pits is a trap, a den, inhabited by a creature as ferocious as the tiger and as subtle as the serpent. Scoop up the sand thus excavated, spread it out on a paper, and you will see a small, oval, sluggish bug, whose main anxiety is to get out of sight as quickly as possible by crawling backward into the sand. Observe him closely, and you will see that his head is furnished with a formidable pair of jaws. This ugly little fellow is the larva of *Myrmeleon*.



THE LARVA—NATURAL SIZE. THE JAWS—MAGNIFIED. THE PUPA—SIDE AND FRONT VIEWS.

In my library I have placed a box of sand in which are kept a number of these ferocious pets. It is interesting to watch the process of digging the pits. The ant lion plows a circular furrow, going backward all the while, and shoveling the sand with his broad and flexible tail. It is invariably thrown outward from the center. A second and inner circle succeeds the first; and this continues until a conical pit is completed, at the bottom of which the ant lion lies, wholly concealed except as to his jaws. Occasionally a small pebble, or other obstruction, will tax the ingenuity of the insect worker. He will lift at the load with either head or tail, as is most convenient, trying to jerk it out of the pit. I have seen the effort repeated twenty times before patience met with its reward. In other instances the obstruction would exceed the ant lion's combined skill and strength, and then the only thing to be done was to abandon the pit and dig a new one in a more favorable location.



THE IMAGO OF MYRMELEON, JUST EMERGED FROM THE COCOON.

When all is made ready, the ant lion lies motionless as if dead, and will continue to do so for days and even weeks, awaiting his prey. Voracious as his habits are, he rejects whatever is dead. To one that had fasted a fortnight I offered a luscious blue-bottle fly, but in vain, because the fly was not alive. On catching another, and a large one, stripping off its wings, I let it fall directly into the expectant jaws, and it was seized instantly and dragged under the sand to satiate the hunger of the voracious foe. The fly was three times as large as the ant lion, but in an hour the carcass was tossed out of the pit, bereft of its juices; the damaged walls of the pit had been repaired, and *Myrmeleon* was ready for further supplies. Seldom does any victim escape.

A young ant lion was seen by a friend of mine to grasp the abdomen of a large fly that had invaded his den, and not being strong enough to conquer, it held on with a grasp so tenacious as to be lifted into the air and carried to a considerable distance before relaxing its hold. It is frequently the case that an ant, on finding himself slipping into the pit, will use his utmost endeavor to escape; but usually a shower of sand brings him down into the vortex. It is not true that the sand is aimed directly at the victim. It is thrown up at random, and one shower is followed by another till the desired object is accomplished. The ant lion varies his methods with different sorts of ants. When the carpenter ant, whose jaws rival those of his foe, falls into the pit, he is seized and held aloft in such a way as not to be able to fight, while the ant lion complacently sucks out his juices. Equal caution is manifested in attacking the pavement ant, which carries a sting. I have to acknowledge that I once left six ant lions of about the same age and size in a cigar box half full of sand, where each had a separate pit, and neglected to make provision for their being fed during my absence of several weeks. On my return I found but one symmetrical pit, inhabited by a sleek, fat ant lion, while around the margin lay the five dry shells of his brothers. This case of cannibalism is the only one of the sort that has fallen under my observation.

Having existed for a long time in a larval state, the *Myrmeleon* prepares for himself a spherical cocoon, in which he passes forty-two days. Toward the last of the pupa state the jaws become serviceable, as the insect uses them to gnaw his way through the walls of the cocoon, whence he escapes as an imago, leaving the jaws behind with the larval skin cast in the transformation. The imago is an elegantly shaped dragon fly, bearing as little resemblance to its primitive form as does the butterfly to the crawling caterpillar.

My experiments have been limited to a single species, *Myrmeleon immaculatus* (De Geer); the specimens being from Indiana and Michigan. This species, however, is widely distributed, from Massachusetts to Georgia and Minnesota. There are two or three species of pit-forming *Myrmeleons*, besides several other kinds that prowl around on the surface for their prey. Those desirous of investigating further will find that there have been excellent descriptions published by Dr. Hagen, in the "Smithsonian Miscellaneous Collections," vol. iv., and by the same author in the *Entomologische Zeitung*, 1873. Other authorities are Brauer, Emerton, McLachlin, and McCook.

It gives me pleasure to acknowledge obligations to Mr. N. B. Pierce, of Ludington, Mich., not only for facts and references, but also for the drawings serving to illustrate this article.

Cholera and Macaroni.

If it is a fact, as alleged by Professor Koch, that cholera is the result of a microbe, what is to prevent the transmission of this dread disease to other countries from Italy, not only through the export of fabrics, etc., alone, but from olives, olive oil, pressed and preserved fruits, macaroni, and other edible commodities shipped from that beautiful and productive country, where the cholera has been raging with such dire results? Be that as it may, a correspondent of the London *Times* writes to that journal, warning people against the use of macaroni and other pastes made in Italy, and specially in the neighborhood of Naples. Supposing the theories of Professor Koch to be correct, we cannot imagine a more likely agent for receiving and transmitting microbes than macaroni, from what we have witnessed of its manufacture in the neighborhood of Naples. The factories for the manufacture of macaroni, between Naples and Pompeii, do not present, during the coolest and healthiest seasons, a pleasing or appetizing sensation to those who are fond of the paste and witness its manufacture for the first time. Macaroni in the course of its manufacture is hung to dry in the open air amid clouds of dust, flies, and stench of all kinds, the locality where it is made being in the dirtiest and poorest districts, and where it is said the cholera has been raging the severest. The *Times* correspondent cheerfully, if not playfully, closes his article by remarking: "One has only to think of this important article of food, which is so much used, being manipulated by plague stricken workmen, who no doubt sicken and die amid the macaroni which is being prepared, under such horrible conditions, to send broadcast over the world and spread the pestilence."

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Does Death Sting?

Dr. G. L. Beardsley, in the *Medical and Surgical Reporter*, concludes that the dread of dying is quite as intense as the instinct of self-preservation. Indeed, it is not improbable, adds the doctor, that numbers would care less about living were the modes of leaving the world a theme for happy contemplation, or an innovation to the routine of plodding that was agreeable. One is remarkably exempt from the crime of hasty induction if he affirms that there is no sane or healthy mortal who anticipates his extinction with any degree of pleasure. The function of dying is absolutely vegetative—we fall to pieces like a flower. This very fact, that the process is chemical, confirms us in the conclusion that the final "throe" is as painless as the inconvenience is nothing to the fœtal pilgrim when he touches on daylight. A moment's examination of the way we are to die will show marks of goodness in our "taking off." The degree of sensibility is proportioned to the integrity of the tissues. An inflammation heightens it; age depreciates it. Any defect in nutrition disturbs the comfort of the individual until the carbonic acid generated in the devitalization of the blood becomes fixed in the cells or is no longer displaced. The sensory ganglia everywhere part with their irritability by virtue of this poison, and cease to conduct currents. The criteria of death are being satisfied, and the process is consummated when this extinction of sensibility prevails at the ultimate filaments. During the progress of this dissolution of the nerve force, this creeping on of the numbness of death, the individual is rapidly passing into a condition of repose, and instead of torture or pangs, a degree of self-satisfaction oft approaching to enthusiasm is realized. The sensations peculiar to the therapeutical operation of opium, hashish, ether, etc., are not improbably akin to the mental activities of the dying. Barring the hallucinations experienced in the stupor as it gains on the subject, the moribund is familiar with naught that borders on suffering. This carbonic acid has poisoned or narcotized the several ganglia, and reflex productions are interdicted. A consummate analgesia prevails. In short, the notion of pain is forbidden the instant that any stimulus fails to excite a response. The condition to this irritability is that the nerve center and track be sound. If this vigor vanishes, reflex phenomena are at an end, and suffering, physiologically speaking, is impossible, because of the arrest of the function of the sympathetic.

Fortunately, for a wholesome study of one's demise, there are assurances abundant, from vivisection, the testimony of those who have been restored to consciousness, and the affirmations of the dying, that there is no physical recoil from death. Burney tried hard to resist the efforts made to resuscitate him from drowning, so bewitched was he by his prolonged slumber. Dr. Solander, the traveler, was so delighted with the sensations of excessive cold, that he was the first to lie down in the snow to realize the luxury of such a death. Wm. Hunter was sorry he was not able to "write how easy and delightful it is to die." Infants die as serenely as they breathe, and not a few among the advanced in years treat death as a friend to their infirmities. Hanging is naturally rated, next to crucifixion, a most distressing procedure. But it is reported of those who have been saved from strangulation, that the agony promised to be brief, and was rapidly replaced by hallucinations of a fascinating variety.

One would fain believe that the kind God who suffered us to feel no sigh in coming would take no delight in turning our farewell into writhing—nay, he does not quit us at the last. He is our greatest benefactor in allowing us to sleep out of weariness. Death is, assuredly, no tax collector; its "jaws" are not the clutches of an assailant; there is no "victory to the grave;" the ghost speeds away from us as it entered, with no ruffle. The sense of death, as Shakespeare has it, is most in apprehension. It is the fear of the lonely night, not the throes of nature, that makes the leaving painful.

Medical Herbs.

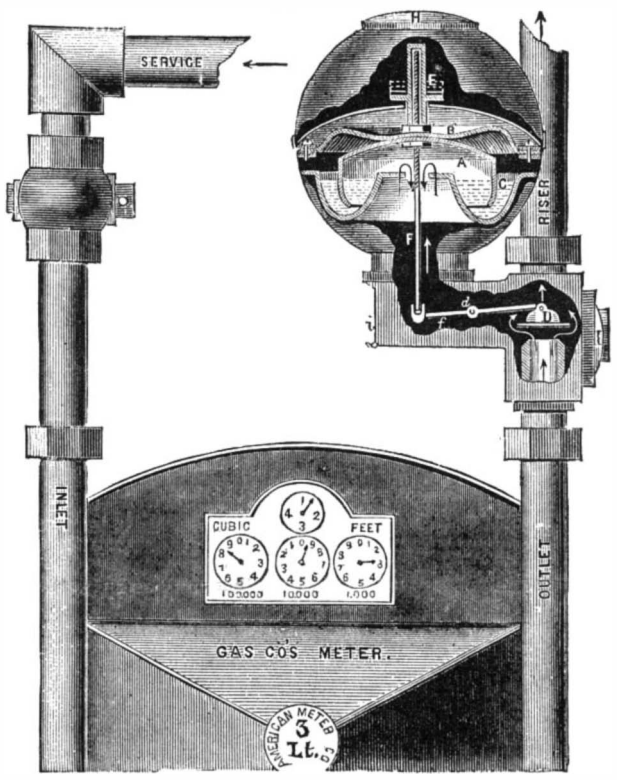
The indigenous plants of Great Britain are too much neglected in the present age, for persons are apt to run after all that is rare or novel in the form of medicine in preference to cultivating our native herbs, so many of which are rich in curative properties. The balm and the dandelion, for instance, are little valued, yet the first is an admirable tonic, and the other a first-rate liver medicine. The balm is, strictly speaking, a native of the south of Europe, but it has been grown in our gardens from time immemorial, and the first record I can discover of its being used medicinally rests with the Arabs, who are said to have taken it to strengthen the nerves: but I can remember the time when "balm tea" was drunk by the laboring classes in South Wales almost as freely as tea is now taken by English cottagers, and most certainly hysteria was at that period a disease unknown among the working classes. Not so now, alas!

Dandelion is admitted into our British Pharmacopœia under the name of Taraxacum, and regularly prescribed in diseases of the liver and spleen; but the poor people were at one time accustomed to make a decoction with the roots, which answered nearly as well as the chemically prepared extract, and the leaves when blanched are taken by the French in salads. It is likewise a valuable antiscorbutic. People put great faith in the doctrine of signatures during the fourteenth and fifteenth centuries, but it is now nearly exploded. It was based upon the following hypothesis, that every natural production indicates by some obvious external mark the diseases in which it is efficacious; and for my own part I really believe that there is a great deal of truth in the idea that not only the colors of a flower, but various other marks on leaves, stems, or roots are typical of their medicinal properties; for example, the spotted lungwort possesses healing powers in consumption, the scarlet poppy has been used with good effect in erysipelas, and the asarabacca, provincially called the foal's foot, or wild ginger, with its curious ear-shaped leaf, was formerly an unfailing remedy for all the pains that affect that organ.—*Science Monthly.*

GAS PRESSURE MODERATOR.

March 13, 1880, we had occasion to notice this invention. The inventor says he took the advice given in our hand book to inventors, entitled "Hold the Fort," to retain the controlling interest in his patent; and that from small beginning thousands of these machines have been manufactured and are now in use.

The manner in which this pressure regulator operates will be readily understood by reference to the illustration. The gas is received from the street through the service pipe, and passes into the meter at its inlet; there it is measured, and passing up into the moderator (the arrows indicate the course of the gas), fills the space under the float, A. When one burner is open this float drops and opens the valve, D, and lets out of the gas meter just enough gas for that one, at a rate of pressure from which all the light is derived from the gas, and so on for every burner that is opened. If one burner is closed, the float, A, rises, causes the valve,



DE PALOS' GAS PRESSURE MODERATOR.

D, to close also, and so on for every burner that is closed. If the pressure from the gas works increases while one or more burners are in use, the valve, D, drops and retards the flow of gas. If the pressure of gas goes down from the works, the valve, D, opens and lets out more gas, which is not forced to the burner or burners, but is admitted through the meter just as the demand is made.

Those who have used this invention furnish some striking testimonials of its efficiency as a gas saver. One large New York house, whose consumption formerly amounted to $6,000 per annum, claim to have reduced the same by the use of this moderator to $4,000 per annum; and the inventor estimates 33⅓ per cent as a fair average of the reduction of gas bills by its use. Among other things, which is not a very small matter, it accomplishes a more perfect combustion of the gas, thus preventing the smoking and sooting of the ceilings, due to imperfect combustion. Also, where "water gas" is used, it reduces the amount of carbonic oxide. This water gas is now a large proportion of the production in this and many other cities, although the companies usually try to keep it a secret.

The inventor says: "The consumer who neglects to place this invention on his meter loses every three to six months a sum of money equal to the cost of one of these instruments; that is to say, he pays the gas company for the value of the gas wasted in his house." About September 21, 1881, and up to November 27, 1883, this instrument was known as "the Owl Gas Pressure Moderator," but by legal proceedings the name was changed.

The inventor is Mr. James S. De Palos, No. 822 Broadway, New York.

Manufacture of Etching Ink.

According to Muller, a liquid for etching on glass has recently been introduced into commerce, and can be used with an ordinary pen. It consists of hydrofluoric acid, ammonium fluoride, and oxalic acid, and is thickened with barium sulphate. A better ink is obtained as follows: Equal parts of the double hydrogen ammonium fluoride and dried precipitated barium sulphate are ground together in a porcelain mortar. The mixture is then treated in a platinum, lead, or gutta-percha dish with fuming hydrofluoric acid, until the latter ceases to react.—*Dingl. Polyt.*

The International Electrical Exposition, Philadelphia.

(FIFTH PAPER.)

These are the last days of the Exposition, and, as one succeeds another, it brings with it an increased number of visitors. Barring Philadelphians, there may safely be said to be very few, if any, visitors who come here out of pure curiosity. The observations of the officers of the Franklin Institute, favorably situated to learn the facts, do much to prove that those visitors who come from a distance are, for the most part, actuated by either commercial or scientific motives. It is not strange, therefore, that, despite the experience at most exhibitions, there should here be a maximum amount of serious attention to the exhibits and a minimum amount of studied inobservance. The good nature of the exhibitors and their employes seems to have no bounds, and rare are the occasions when they address themselves to the inappreciative or those wholly unfamiliar with applied science.

Of the multitude which daily pours through the doors, the majority appears to be more or less interested in comparing the various electric lighting systems. They seem to derive much pleasure though little profit from this, as the various companies, though unsparing of so-called statements of what their several apparatus are capable of, will not permit, save in a few exceptional cases, tests to be made on the premises.

Those desirous of buying an electric lighting plant with an idea of selling light are, naturally enough, as much interested in knowing the amount of current used and the cost of generating it, as they are in the intensity of the light and the arrangement of the apparatus. As to the arc light urban as well as suburban capitalists and projectors have learned ere this how elusive are its promises of profit, save when installed under peculiarly favorable conditions.

The services of the diplomat as well as those of the electrician seem to be required in disposing of arc light plant, and no little ingenuity is shown at the headquarters of the various arc light companies in explaining why, there being so much profit in selling the light, they should so strictly confine their efforts toward selling the plant.

It is something of a disappointment that the scheme of charging secondary batteries placed in dwellings and offices from the arc light wires running through the streets has not been practically illustrated, so that it could be seen in all its workings.

It is an ingenious project, and, if it could be publicly shown that the batteries can be economically charged by day by means of the same electric mains which at night furnish the current for the arc lights in the streets, it would prove a dangerous rival to those systems in which the lights are fed directly from a central station. For the steam engine is, at best, uncertain, and like all mechanisms subject to accidents; and though this may be foreseen and provided for through the agency of auxiliary engines, the provision does but add to the cost of the plant.

Many of the electricians gathered here at the Exposition take an absorbing interest in the so-called "underground problem." Opinion seems very equally divided as to the practicability of the scheme. To all appearance, for every electrician interested in an electrical company, who calls it impracticable, his fellow may be found holding the contrary opinion, and able to maintain it with equally convincing proofs. This does much to sustain a learned jurist, who has defined an expert as one who can testify on either side of a case with equal facility.

Among those who believe the wires may be efficiently and economically buried is Prof. Preece, the eminent English electrician. At a recent meeting of the telephone managers a paper was read by an employe of the American Bell Telephone Company, whose duty it is to keep the lines in running order. The object of the paper was to show that telephone lines, at least, could not be efficiently operated underground. At the conclusion of the reading Professor Preece took the writer of the paper severely to task for the incorrectness of his conclusions, and remarked that if that was "the result of his investigations he must have sadly neglected his business." In support of that part of Professor Preece's assertion regarding underground wires which attributes to them efficiency of working, there are some experiments making here in the Exposition building. This underground line extends from the Exposition building in West Philadelphia to the Pennsylvania Railway station in Kensington, a distance, when the route taken by the wire is considered, of more than eight miles.

It must be said that the results had with the telephone wires—the most sensitive to induction and retardation of all the wires that it is proposed to bury—are more than encouraging. Indeed, it is very doubtful—so say telephone experts who are watching the experiments—if an overhead telephone line could be operated more satisfactorily, even under the most favorable conditions.

Mr. Frempt, the superintendent of the underground company whose conduit and system is being used, is very anxious to have a comparative trial between his line and an overhead line. While officially inviting such a test, he begged the telephone people to appoint a day of trial when the conditions of weather should be most favorable to the overhead system.

This experimental underground line does something toward the solution of the important problem. But it should be remembered that it is an experimental line. Whether it would remain in the excellent condition it i

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now in for an extended period, time only can prove. The question of cost, too, should not be forgotten, for in importance it is second only to that of efficiency, and it is improbable that an expensive system of underground conduits would ever be adopted or placed in general use for this, if for no other reason—that it would result in raising the rates for service; and, as we know, the public is looking for a reduction in the rates, that an increase would not be tolerated.

The system of underground conduits now in use in Chicago, as exhibited in the Exposition, does not differ essentially from those systems which have already been described in these columns. The section now in successful operation in Chicago consists of eleven miles of conduit, containing nearly two hundred miles of wire, and was built, it is said, in four months. The manager of this system says that the company has one main office and six branch offices, with facilities for opening many others. The Postal Company, he says, has a line parallel to his underground, wherein is laid a conduit containing about one hundred and eighty miles of wire. So far this year, he says, the city of Chicago has buried one hundred miles of wire, and proposes at an early day to have every wire in the city, whether light, telephone, or telegraph, under ground.

A little apparatus by which a dwelling house or office may be kept at a uniform temperature is noticeable, not by reason of novelty, which it doesn't possess, but because of recent improvements which render it fairly reliable. Those who have ever tried to regulate a furnace fire are aware how much time it requires and how unsatisfactory are the results. The house being too warm, the dampers are adjusted and the windows opened. As a result the temperature, which before was nearly tropical, falls too low for comfort. The electric regulator is intended to look after the furnace fire, or rather its temperature, and by preventing it from becoming too hot effects a not inconsiderable saving of fuel. It consists of a thermostat, a clock, an electric jar, and a valve. The thermostat is hung up in any of the living rooms; the clockwork and valve being placed on a branch of the smoke-pipe of the furnace. When the instrument is properly set at a certain temperature, the draught will be checked when the heat rises above it, and opened again when it descends below it. It is exceedingly sensitive and does not easily get out of order.

In the philosophical department is shown a new electrodynamometer for the measurement of very feeble alternate currents. It differs from the common type of electrodynamometers, because of the suppression of the movable solenoid and the absence of the intricate scheme for suspension which goes with it. An iron rod performs the same office as the movable solenoid. This iron rod is readily poised; a thread of very weak torsion giving marked satisfaction. The apparatus is both sensitive and quick, for the movable portions have little or no weight.

During a recent test the blowing of a horn attached to a telephone so violently agitated it that the deflection of the group of wires was too great to be accurately observed.

An interesting feature of the present Exposition is the presence of large quantities of historical apparatus. It is not enough that the student and the mechanician should have before him the newest form of apparatus, but also that he should see the various mechanisms of a like nature which preceded it. This enables him to follow the various improvements from the earliest application of a newly discovered law through all the various stages on the road to perfection; to observe how obstacle after obstable is removed; how one original idea suggests another, until finally that which at first was a cumbersome, intricate piece of machinery of but imperfect operation is finally trimmed down and remodeled into a smooth-working apparatus of few parts and efficient action.

One of the most interesting of these crude apparatus is shown among the foreign exhibits. It is a focusing electric lamp of the arc type made by Dubosc of Paris, and called the Foucault regulator. This lamp is in many respects similar to that brought hither in 1874 by Prof. Tyndall, and exhibited by him in his lectures. The lamp shown by Tyndall was intricate in the extreme, and of such costly construction that it was fit for little else but exhibition during a laboratory lecture. The lamp shown in the present Exposition constitutes what might be called an improvement on this. Clockwork is make to operate the carbons, as in many of the arc lights now in general use. Through the agency of an electro-magnet with coils forming part of the circuit, that feeds the lamp, the carbons, when the current is too strong, are made to approach each other. The armature falls when the current is not strong enough, and this reverses the gearing of the clockwork mechanism, and they again draw apart, the one from the other. As said before, such lamps are intended to show the several ingenious contrivances which led to the present type of arc lamp rather than as models for a general system for practical illumination.

Throughout all the foreign section no lamps show such constant and well conceived automatic action as some arc lamps of the Gerard pattern. In these, levers of delicate construction are acted upon by two springs influenced in turn by an electro-magnet. Each of two levers has pins affixed, and these, when inclined to a certain degree, fiamly grasp the upper carbon. The levers, influenced by the electro-magnet while in shunt circuit, permit the upper carbon to fall from its grasp upon the lower carbon. The shunt magnet, as soon as the circuit is made again, weakens its force, the levers are put back in the same condition as before by the action of the springs and clasp the upper carbon, elevating it always to a sixteenth of an inch and forming the arc.

Among the German exhibits there is a curious arc lamp having the lower or negative carbon floating in a tube of mercury. As long as the current is powerful enough, the lower carbon is steadied by a lever, while at the same time pressing the upper carbon upward to the required height. The weakening or lessening of the current permits the upper carbon to fall by the relaxation of the lever.

To those interested in arc lighting there is nothing in the Exposition which can prove so interesting as the specimens of zircon shown in all its peculiar conditions. It is well known that the necessity for constantly replacing the exhausted carbons in the arc lamps makes the system both inconvenient and expensive. Now this zircon, it is claimed, will, when combined with carbon and other elements, hold the electric current indefinitely without showing any diminution. This shows it to be far harder than platinum or iridium, for neither of these will stand such a test, though iridium and platinum are sometimes used in place of one of the carbons in arc lamps. Zircon has not thus far been found in large quantities outside of Henderson County, in the western part of North Carolina. When the specimens were first brought to light, it was thought of little or no value as a metal, or rather the use for which nature had designed it was not yet discovered. After some experiments had been made, however, zircon gave evidence of possessing unusual qualities in withstanding intense heat, and specimens were sent to the Smithsonian Institution, in Washington, to be tested. Here it was shown that the newly discovered mineral would hold a powerful electric current without fusing, and that, since there is no combustion during the passage of the currents, there was no necessity for a vacuum lamp, as in the incandescence systems the ordinary arc lamp of a much simpler form being all required.

It has for some time been promised that a battery by which light could be changed into electricity would be shown among the foreign exhibits, and tests made before those interested. Up to last week, however, this battery had not arrived, and no little disappointment has been felt by those interested in such experiments. As explained, the chemical constituent of sunlight is made to furnish the power. It has been shown, however, that heat waves will so influence a thermo-pile as to generate a current. The battery itself is said to be made of glass, having within a porous cell filled with mercury. There is also a solution of table salt and sulphate of copper, two electrodes, one of them being made of sulphide of silver and the other of platinum. Near the main entrance of the hall there is displayed an improved system of electrical matting, through the instrumentality of which the unsuspecting burglar, upon entering a dwelling or any room thereof, is made to announce his arrival by setting a gong a-going. Indeed, it will when in good working order do more than sound an alarm. It will light the gas and call the servants. The matting itself is invisible, being placed under the carpet. It is composed of thin strips of poplar fastened to muslin. On one side there are fine springs fastened through the matting with the wires that connect the bell and battery. Curiously enough, the removal of the foot, after once treading upon the matting, does not stop the alarm, and even cutting the wires will not serve to check it.

A new and unique system of railway danger signals is to be seen in the Exposition, and, although it has not, so far as can be learned, been sufficiently tried to prove its efficiently, it merits by reason of its novelty, some little attention. In the system described in these columns two weeks ago, the danger signals along the line were made to confront the engineer whenever he approached another train on the same track; the rails being used to transmit the current. In the railway cab electric signal system, the engineer, if blind as a bat, must needs be aware of danger, because the alarm is made to sound from his own engine. A praiseworthy feature of this system, as well as of that before described, is the fact that the warning signal is not a result of force, but rather of the absence of force, so that a failure of the parts to work does not lead to deception. In other words, the normal condition of the signal is at "danger," and only when the apparatus is working smoothly, and consequently when the track is clear, can the signal whistle be prevented from sounding in the ears of the engineer. The whistle or gong is made to sound in the cab of the locomotive by means of the breaking or opening of a normally closed electric circuit.

This necessitates, of course, the presence upon the locomotive of an electric generator, which is coupled to a small motor fed from the boiler of the locomotive. The operation of the apparatus is thus explained: The two poles of the dynamo terminate by means of wires, one to the body of the locomotive and one to the frame of the tender; both having metallic contact with the rails by means of their wheels. These two points or terminals formed by the wheels are insulated from each other, so that, when on the rail, the wheels of the locomotive and the wheels of the tender are only connected together electrically by means of the rail. If the tender has a wooden frame, the insulation is, of course, complete, but if the frame is of iron the draw bar should be insulated. This gives a closed circuit in action by the aid of dynamo, locomotive, tender, and rail.

There is a magnet in the cab holding an armature, and the circuit passes through it. The opening or interrupting of this closed circuit results in making the armature forsake its magnet, and this by means of the ordinary lever action sets a whistle or gong a-going. The warning sounds continue until the engineer replaces the armature to its magnet, which is again held by the current. The current is interrupted and the circuit opened by insulating two abutting rails, the one from the other. Hence when the wheel of the locomotive is on one rail and that of the tender upon the other, the insulation between the rails causes the circuit between the wheels to be interrupted; the armature leaves its magnet, and the danger signal is sounded. The insulation of the two parallel rails is of the same character, and the circuit is cut for the wheels on either side. The control and working of the signals is thus described:

From two insulated abutting rails, separate wires are led, to join which would destroy their insulated condition. These wires are led to any given distance for the purpose of signaling. They are made to terminate at a switch, a drawbridge, a station, at blocks, or any other points from which a locomotive may be signaled or which a locomotive may signal.

The closing of a switch closes the wires; if opened, they are opened. When the insulated joints of the wires interrupt the current through the rail from the locomotive to the tender, the current must follow the wires leading from the two rails. For example, the two wires being closed at a distant signaling point, the circuit in the locomotive will also be closed when passing the insulated point where the rail is joined by the wires, while, if the wires are open at a distant signaling point, the circuit in the same position on the locomotive will be opened, and as a result the warning signal will be sounded as the insulated joints are crossed. Hence, as long as no sound comes from the danger signal the track is clear.

The Telephone Suit.

The lawyers concluded their arguments in the great suit of the American Bell against the People's Telephone Company on October 2, when Judge Wallace, as is usual in such cases, took the papers and reserved his decision, which may, according to custom, not be handed down for one month or three months. The opinion of the court in such cases usually covers the leading points of the law and evidence, as it is only on this and the complete record that the cause can be appealed to the United States Supreme Court. Although the Drawbaugh people had to show priority of invention over Bell on their own account, or antecedent invention and public knowledge thereof as from any other inventor, they seemed to have confined themselves in the proofs almost entirely to Drawbaugh's inventions, without introducing evidence as to the work of other investigators in this line. The great elaboration with which the case was prepared for trial, however, precludes any supposition that this course might have been followed through inadvertence. Of the great array of counsel engaged, only four took part in the presentation of the case to the court—Messrs. J. J. Storrow and E. N. Dickerson for the Bell Company, and ex-Judge Lysander Hill with Senator Edmunds for the People's Company.

The New York and Brooklyn Bridge Extension.

In our issue of April 12, 1884, we described and illustrated the proposed improvement at the New York terminus of the East River Bridge, by which increased facilities would be obtained for switching the cars. The improvement contemplated consisted of an extension of the tracks across Chatham and Centre Streets, making an entrance for car passengers on the west side of Centre Street, and means of making more ready connection between the bridge and the elevated railway. The great want of such improved facilities has been apparent for many months, and yet the work had hardly been commenced before it was stopped by the refusal of the New York city authorities to allow the necessary street opening. Judge Lawrence, in the Supreme Court, has now decided, however, that the Bridge Trustees have the right to proceed, and an immediate commencement of the work is promised. The arrangements for carrying out the original plan have been so thoroughly matured that it is thought the extension may be completed by the middle of the winter.

The Mosquito as a Yellow Fever Vaccinator.

The editor of the St. Louis *Courier of Medicine* gives an account of the studies of Dr. Carlos Finlay (*Chronica Medico Quirurgica de la Habana*) with reference to mosquitoes and yellow fever. Dr. Finlay believes that he has demonstrated that yellow fever is inoculable by the sting of the Cuban day-mosquito during the third, fourth, fifth, and sixth days of its evolution, but not during the first two days nor after the sixth, no matter what be the severity of the symptoms at those periods. The duration of incubation offers the same variations in the inoculated as in the natural disease, in either case varying from five to twenty-four days. The duration and intensity of the fever produced by inoculation by the mosquito appear to be in proportion to the number of punctures and the quantity of inoculable matter retained by the insect's sting. The inoculation by one or two punctures in no case produced any other morbid phenomena than those of benign natural yellow fever. Dr. Finlay thinks that the results already obtained warrant the assertion that the inoculation of yellow fever by one or two mosquito bites is a plausible means of imparting, without peril, immunity aganst the severe forms of the disease to which those are exposed who well in an infected district.

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ENGINEERING INVENTIONS.

A revolving cylinder engine has been patented by Mr. John J. Blair, of Tacoma, Wash. Ter. The piston remains stationary and the cylinder revolves, the steam being admitted into meniscus-shaped spaces between the inner surface of the cylinder opening and the outer surface of the piston only during one-quarter of a revolution, working under expansion during another quarter.

An automatic electric shut off for water and gas pipes has been patented by Mr. Thomas P. Hughes, of Denver, Colo. It has a spring held lever, a connecting lever, and a drop rod interposed between a stop cock in the pipe and the armature of a magnet having an electric thermometer in its battery circuit, so a certain fall of temperature will break the circuit and release the rod, allowing it to close the stop cock and shut off the water or gas.

AGRICULTURAL INVENTIONS.

A potato digger has been patented by Mr. Lyman Norton, of Hartford, N. Y. It has a beam with a pair of curved standards connected at their lower ends by a plate forming a seat for the scoop, having also a curved separating rod and a shoe with hinged flexible arms, whereby the potatoes are separated from the soil as they pass together from the rear edge of the scoop.

MISCELLANEOUS INVENTIONS.

An artist's box has been patented by Mr. George Stirrup, of Brooklyn, N. Y. This invention provides for certain improvements in the construction, arrangement, and combination of parts in boxes which artists use for carrying color tubes, brushes, water, etc.

A hame fastener has been patented by Mr. George W. Greene, of Abington, Ind. It consists, in combination with a stirrup for receiving the hame strap, of a locking lever for tightening and fastening the hame; it is light and strong, easily operated, and inexpensive.

A printing press has been patented by Mr. Theophilus Reichard, of New York city. This invention covers a novel construction and motion in operating the actuating shaft and controlling the motion of the platen in small printing presses to be operated by steam power or treadle.

A thill coupling has been patented by Mr. George E. Smith, of Newark, Ohio. It is a pole and shaft shackle, which may be readily connected or disconnected to admit of the change from pole to shaft or the reverse, all rattling being prevented, and no rubber or leather filling being necessary.

A drip cup and binder for paint brushes has been patented by Mr. John T. Sutton, of Urbana, Ill. An elastic binder fits close around the base of the handle and the head of the brush, where there is a drip cup and rigidly attached sleeve, to prevent the paint from getting between the sleeve and handle.

A derrick has been patented by Mr. Chas. F. Ruff, of Phœnixville, Pa. The invention consists principally in providing the derrick with adjustable braces for laterally bracing it, to prevent the derrick from tipping sidewise in either direction, and is alike applicable to hand and power derricks.

A bale tie has been patented by Messrs. Owen P. Brown and William S. Deidrich, of Smithville, Ga. This invention covers a strip with a loop at each end and a hook pivoted at one end, the hook having on its free end a lug, prong, or projection for locking it in place, so the tie can be opened or closed easily and rapidly.

A toy money safe has been patented by Mr. Edward T. Gibson, of Minneapolis, Minn. It has separate chambers for coins of different value, and is intended to cause any coin inserted to deposit itself in the proper chamber, besides enabling a person to ascertain how much money the safe contains without disturbing it.

A leather working machine has been patented by Mr. John A. Panton, of Quincy, Mass. The object of this invention is to make more convenient the setting and adjustment of such machines as the Fitzhenry and the Holmes, the construction doing away with the counting of threads heretofore necessary in adjusting the parts.

A furnace has been patented by Mr. Thos. C. Zetzsche, of Okawville, Ill. In combination with a cylindrical casing, lugs are made to project from the inner surface to support the grate, and the ash pan is suspended by rods from the lugs, making a furnace for heating kettles, caldrons, etc., which is simple in construction and saves fuel.

A saddle and bridle for breaking horses has been patented by Mr. Hugh O. V. Kelly, of Virginia City, Montana Ter. The saddle and bridle are strapped together in such a manner as to form a bitting and breaking rig for horses and colts, to prevent them from kicking, bucking, and throwing themselves or their rider.

A circular saw mill has been patented by Mr. John H. Jones, of Dardanelle, Ark. The invention covers a stationary frame with saw arbor and pulley, and a sliding adjustable frame with saw arbor and pulley, with vertical standards between, and adjustable tension rollers for the belt, with various novel features in construction and arrangement.

A return registering envelope has been patented by Mr. Jacob M. Crull, of Harrisburg, Pa. It has peculiarly formed flaps, and a fixed pin on which a washer, key, and addressing tags may be fastened, making an envelope more especially intended for use by express companies, and in the postal service for registered letters and packages.

A saw horse has been patented by Mr. Richard Wylie, of Napa City, Cal. It is constructed of two pairs of crossed legs united by a suitable bolt, the legs each being formed of two leg bars with recesses in their inner surfaces, a third leg bar being held between the recessed bars, making a very stiff and rigid horse, which can be quickly erected or folded.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY; ITS THEORY, SOURCES, AND APPLICATIONS. By John T. Sprague. [Second edition.] E. & F. N. Spon, New York and London.

HANDBOOK OF ELECTRICAL TESTING. By H. R. Kempe. E. & F. N. Spon, New York and London.

THE PARIS ELECTRICAL EXHIBITION OF 1881. Report of Major D. P. Heap, U. S. A. D. Van Nostrand, New York.

Mr. Sprague is a member of the English Society of Telegraph Engineers and Electricians, and has here given the public an eminently practical work. Of the first edition 2,000 copies were sold, and the volume is now greatly enlarged. The book deals with the principles of the study of electricity, rather than making a historical record of facts, the instruments necessary for the understanding of the subject being so far explained that those who have some mechanical aptitude may construct for themselves a great variety of practical apparatus. The thousands of individuals who are now making experiments for themselves in this most interesting field may here find valuable aid—The handbook of Mr. Kempe, which now reaches its third edition, is for the more advanced student, or the experimentalist who is ready to attempt the more difficult problems in electrical engineering. It describes all the most approved methods of measurement of electrical force, with the apparatus required, cable testing and how faults are localized, specifications for cable manufacture, and system of testing during the manufacture. A diligent perusal of these two books will make the investigator acquainted with most that has been done in the development of electrical science up to date.—The report of Major Heap appears simultaneously with its issue from the government printing office, and apparently from the same plates. It evinces the care and comprehensiveness of scope which have characterized so many former publications from the department of engineers of the United States Army, and forms a valuable part of the record of the world's progress in the branch to which it relates.

ART YEAR BOOK. John Mason Little, Boston, Mass. Price $4.

This volume is an outgrowth of the illustrated catalogue of the Fine Arts Department of the New England Institute, which in 1883 reached its highest attainment, appearing as a magnificent volume of about seventeen full page etchings, besides a number of albertypes and photographs, all executed in the highest state of the several arts employed in its embellishment. A great number of our cleverest American artists have been engaged on the Art Year Book for 1884, the illustrations of which are taken from subjects exhibited at the last art exhibition of the Institute, Boston. To Mr. Arthur B. Turnure, of the Art Age Press, was intrusted the arranging of the cuts and the printing and binding of the volume, and he has in this succeeded in producing the choicest effect both in arrangement of the engravings and in the binding, the covers being of white parchment bond paper, on which is printed in colors a Japanese design by Mr. Turnure, which adds much to the beauty of the binding.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 136 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

A half interest in Patent No. 280,080 for sale cheap. (Horse Power. See cut in SCIENTIFIC AMERICAN, July 26.) Address R. F. Rasmussen, Omaha, Neb.

Carbon Plates. Bowe, 48 R. R. Ave., Jersey City, N.J.

For Sale.—A patent right of Weighing Scales for any purposes. Address T. Ziersch, Dedham, Mass.

Shafting For Sale.—Excellent 2d hand, with its couplings and coupling bolts all fitted, true, and polished; with or without hangers, as customer may prefer; any part or all; 114' 4''; 224' 3⅜''; 216' 2⅞''; 24' 2½''; 16' 2 3-16''; 12' 2⅜''; 160' 1 15-16''; 32' 1⅝''; 53' 1 7-16''; 27' 1⅜''. Send for full particulars and prices per lb., stating size and amount required. Forsaith Machine Co., Manchester, N. H.

The Cyclone Steam Flue Cleaner on 30 days' trial to reliable parties. Crescent Mfg. Co., Cleveland, O.

For Steam and Power Pumping Machinery of Single and Duplex Pattern, embracing boiler feed, fire and low pressure pumps, independent condensing outfits, vacuum, hydraulic, artesian, and deep well pumps, air compressors, address Geo. F. Blake Mfg. Co., 44 Washington St., Boston; 97 Liberty St., N Y. Send for Catalogue.

Quinn's device for stopping leaks in boiler tubes. Address S. M. Co., South Newmarket, N. H.

Linen, Cotton, and Rubber Hose, suitable for all places. Greene, Tweed & Co., New York.

Mills, Engines, and Boilers for all purposes and of every description. Send for circulars. Newell Universal Mill Co., 10 Barclay Street, N. Y.

Wanted.—Patented articles or machinery to manufacture and introduce. Lexington Mfg. Co., Lexington, Ky.

Brush Electric Arc Lights and Storage Batteries. Twenty thousand Arc Lights already sold. Our largest machine gives 65 Arc Lights with 45 horse power. Our Storage Battery is the only practical one in the market. Brush Electric Co., Cleveland, O.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 86 John St., New York.

Stationary, Marine, Portable, and Locomotive Boilers a specialty. Lake Erie Boiler Works, Buffalo, N. Y.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

The Hyatt filters and methods guaranteed to render all kinds of turbid water pure and sparkling, at economical cost. The Newark Filtering Co., Newark, N. J.

Steam Boilers, Rotary Bleachers, Wrought Iron Turn Tables, Plate Iron Work. Tippett & Wood, Easton, Pa.

Send for Monthly Machinery List to the George Place Machinery Company, 121 Chambers and 103 Reade Streets, New York.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent agency, 361 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Electrical Alarms, Bells, Batteries. See Workshop Receipts, v. 3, $2.00. E. & F. N. Spon, 35 Murray St., N.Y.

Munson's Improved Portable Mills, Utica, N. Y.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 141.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 142.

Curtis Pressure Regulator and Steam Trap. See p. 78.

Brass & Copper in sheets, wire & blanks. See ad. p. 222.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 20,000 Crank Shafts and 15,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 222.

Heavy Walrus Leather for polishing. Factory supplies of all kinds. Greene, Tweed & Co., 118 Chambers St., New York.

Corundum Wheels; cut faster and wear longer than emery. Pratt & Whitney Co., Hartford, Conn.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 77.

Notes & Queries

HINTS TO CORRESPONDENTS.

Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or mail, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) H. A. S.—Use the solid paraffine for preserving eggs.

(2) C. F. B. asks: Will rubber be affected by direct contact with hot steam? If so, in what way and how soon? A. It becomes hard and inelastic in a few weeks.

(3) H. B. asks for a formula for making ink suitable to print on tin with a rubber stamp. A. Use printer's ink.

(4) S. H.—The gold fish (*Cyprinus auratus*) is a native of China, said to have been introduced into Europe in 1691, thence to the United States.

(5) J. M. S. writes: In a room for public purposes, 43 feet by 54 feet 6 inches inside measure, the ceiling highest in the middle, but not arched, what would be the acoustic properties when the distance between the floor and highest point of ceiling is 27 feet? A. In parts of the room there will probably be considerable reverberation. The general acoustic properties will depend much upon the location of the speaker, the angles of the ceiling, and continuity of sides or position of rostrum.

(6) J. G. E. asks: How are copper tubes bent, say 1¼ inch tube in a 5 inch curve? A. Bend after annealing and filling with resin, around a grooved former, then melt the resin out. 2. What is the gauge of copper tubing to stand 120 pounds pressure on the inside with steam? A. Three thirty-seconds of an inch thick.

(7) R. H. C. asks where to get small steel balls, such as are used in the hose carriage wheels. The balls are about three-eighths of an inch in diameter. A. These balls are not on sale. You will have to get them made by a machinist.

(8) A. J. M. asks: To what height will a siphon draw water? When the supply end reaches 33 feet, balancing atmospheric pressure, does not the siphon cease to operate? A. Yes.

(9) H. B. G.—You can make plastic metal, or what are called amalgams, by treating precipitated copper with mercury—2 of copper, 3 of mercury, by weight. You can use the fusible alloy of 1 part each of tin and lead to 2 parts bismuth by weight for casting on gelatine plate. It melts in boiling water. Buy celluloid from the Celluloid Manufacturing Company, Newark, N. J.

(10) H. L. C. asks: 1. Where can the mercury flasks used for constructing boiler shown in SUPPLEMENT, No. 182, be procured? A. Of persons using mercury for silvering looking glasses or other purposes; sometimes of the junk dealers. The flasks are almost all made in Pennsylvania, and cost, new, to the miners, $1.15 each, second hand ones selling for 80 to 90 cents each. 2. What pressure will they stand? A. They are considered good for a thousand pounds pressure; they are half an inch thick at the top, three-eighths inch at the bottom, and three-sixteenths inch at the sides of the shell.

(11) J. S. H. asks how much coal a steamer burns per day in crossing the ocean, how many days it takes to cross, also the amount of tonnage. A. The first class steamer America burnt about 200 tons a day; the Oregon nearly 350 tons a day; the quickest passages of both have been under six days and a half; the tonnage of the America is 5,528, and that of the Oregon 7,375.

(12) F. A. W. writes: Some time since I read in your Notes and Queries advice to add glycerine to some mixture as a preventive, or partial preventive, against freezing. May I ask how much should be added to say one gallon of water or other fluid to accomplish this object? A. One per cent by measure for each degree of cold below 32°.

(13) J. W. L. asks (1) the dimensions necessary in a balloon to lift 500 pounds, said balloon to be of a conical shape. A. Diameter 26 feet, for hydrogen gas. 2. The difference in the lifting powers of gas and hot air? A. Hot air has very little buoyancy, probably one-fifth as much as hydrogen gas.

(14) S. G. writes: Have trouble with stationary engine—running hot, gumming, etc.; have tried every imaginable way, but have failed. A. You are probably using bad oil. Use the best lard oil or a heavy petroleum oil made for engines.

(15) H. L. asks how many square inches there are in 3 inch safety valve. A. If the opening is exactly 3 inches, the area is 7·0686 square inches.

(16) G. L. T. asks: Which is the best floor for roller skating rink—a cement or hard kiln—dried floor? Which wears out the rollers the quickest? A. The hard wood floor. Cement floor disintegrates and becomes dusty, and then is destructive to the rollers also.

(17) W. S. W. asks: 1. How fast does heat travel? A. It depends entirely on the conductor. 2. Can heat be brought to a focus by passing through a lens? A. Yes.

(18) N. K. writes: If you were to put a 2 inch pipe in a 40 foot well, and put a pump on top of the ground, with the valve 40 feet from the water, would the pump work? If not, how high will the water come up in the pipe? A. Twenty-eight to thirty-three feet is the greatest lift for an ordinary pump.

(19) F. I. P. asks the ingredients of the brown powder used by cigar makers to produce the Madura color on cigars? It is soluble in water or spirits, and is of a mahogany color. A. A solution of an aniline color known as acid brown is the article used. It can be procured of dealers in dyestuffs.

(20) J. I. C. asks what should be the dimensions of valves, ports, and bridges of an engine 2x4 inches, to run 250 revolutions per minute, also size of pipes and what power should it develop; how large a boiler should be needed, and how large and heavy a fly wheel should be needed, and throw of eccentric, etc.? A. The steam openings should be ¼ inch by 1¼ inches, exhaust ½ inch by 1¼ inches, bridge ⅜ inch. Steam pipe ¾ inch, and exhaust 1 inch. Boiler should be 20 inches to 24 inches diameter and 36 inches high, tubular, and have 35 to 40 feet fire surface. Throw of eccentric would depend upon the lap of the valve and mode of connection; if direct, about seven-sixteenths inch. Fly wheel about 18 inches diameter and rim 2½ inches diameter.

(21) W. E. asks for a recipe to soften horse and cow hair. A. Use a solution consisting of 1 ounce glycerine, 20 grains potassium carbonate, 1 salts of tartar to the pint of water.

(22) G. L. F. writes: 1. I want to transmit power by wire rope about 175 yards; can I do it successfully? A. Yes, by making two ropes run over a double carrier wheel in the center. 2. In tarring or pitching felt roof, what can I use to make it set good and hard, so it will not run in hot weather? A. Boil the tar to thicken it, and use all the sand that it will take when spread.

(23) F. D. B. asks: In regard to the manufacture of "potato flour or farina," what it is worth per ton, and what quantity of potatoes is required to make a ton of flour. A. The manufacture of potato flour is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 313, under the title of "Potatoes and their Utilization." Cuts illustrating the articles used in the preparation are there given. Its value in New York is 4¼ to 4⅜ cents per pound.

(24) S. B. B. writes: I have a solution of nitrate of soda which has been made in an iron kettle with a copper worm to heat it. If the solution is allowed to crystallize, the crystals turn blue. I have the same result with a copper worm and lead kettle. I suppose it to be the result of chemical action of the metals. Can you inform me what I can do to cause the copper or lead in the solution to deposit or drop, or to take the color out? A. The blue coloration is probably due to the copper. The latter can be more or less completely removed by being precipitated with iron.

(25) T. C.—Shellac or French spirit varnish with a small quantity of fine lamp black added to it forms a brilliant black varnish, which might answer your purpose.

(26) W. S. B. asks by the use of what acids or tools he can cut a round or oblong hole in a piece of window glass which is about one-sixteenth inch thick. A. Use a copper tube charged with emery and water and revolved in a lathe or hand drill.

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(27) C. Y. M. asks whether a long coupled wagon pulls easier or harder than a short coupled, or whether it is the same; and if one pulls easier than the other, why? A. The long coupled wagon will draw the easier, because the horses will have a greater leverage over a twisting strain, caused by an obstruction on one side of the road.

(28) W. G. R. asks how to prepare thin paper that, by writing on it with a pointed stick while lying on white cloth, the writing will be transferred to the cloth. Would like to have it stand washing. A. We do not know of an indelible transfer paper.

(29) H. G. M. asks the formula of a composition used in soldering to make solder stick. A. Dissolve zinc in muriatic acid until effervescence ceases; dilute it with a quantity of water equal to that of the acid.

(30) J. S. writes: I make an axle grease which I put up in cans. The trade calls for goods put up in wooden boxes. I placed some of my grease in such a receptacle, but cannot prevent the oils penetrating the wood. How can I treat the boxes in order to avoid that? A. Coat the inside of your boxes liberally with glue size.

(31) A. C. H. asks: What are the ingredients of gold solutions that deposit a red color on metal to be plated? I use the Smee battery; has that any effect on the coloring or gilding in this case, or what battery is best to use? A. A Smee's battery is as good as any for the purpose. For information on electro-metallurgy, consult SUPPLEMENT, No. 310.

(32) C. L. W. writes: Our house is alive with fleas from a pet cat. We have tried Persian insect powder without much effect; can you tell me of anything better for the purpose? A. The oil of pennyroyal will drive your fleas away. Beds made of pennyroyal for dogs to lie on will also drive away fleas.

(33) G. W. S. asks a receipt of some liquid or oil to place in gravity batteries that will keep them from evaporating and using up so quick? A. Any non-drying oil will do; try common lard oil.

(34) G. S. T. writes: I have an eighty barrel water tank on barn; the bottom of tank is 24 feet above the ground. A windmill supplies the tank automatically. My carpenter's shop floor is 26 feet below low water mark in tank and about 6 rods in a lateral direction; with a two inch pipe connecting tank to a suitable turbine at the shop, what amount of power ought to be developed, and in what time 80 barrels be run out, when turbine is at full work? A. The discharge of the 80 barrels of water will develop ¾ horse power for an hour, or ⅛ horse power for 2 hours. You will not realize more than 60 to 70 per cent of this power through a motor.

(35) Engineer writes: I have some celluloid billiard balls that have become faded. I wish to recolor them. What shall I use? A. Use the following colors in the proportion of about 10 grains to the gallon of water: Black, use nigrosine; for violet, methyl violet; blue, soluble blue; red, aniline red or magenta; green, malachite green. Dissolve these aniline colors in hot water. The balls are immersed in the hot water, and then allowed to cool in the coloring solutions until sufficiently dyed. Perhaps three to four hours.

(36) J. P. B. writes: Please give me a recipe for making the following inks, aniline preferred: green, blue, burnt sienna, yellow and purple. A. Green: Dissolve 1 part of iodine green in 100 to 110 parts of hot water. This ink writes a brilliant bluish green; if it is desired to give it a yellowish green tint, a little picric acid is to be added. Blue: Dissolve 1 part of the soluble bleu de nuit (bleu de Paris) in 200 to 250 parts of hot water. Yellow: Dissolve 1 part of picric acid in 120 to 140 parts of water. Purple: Dissolve methyl violet in sufficient water. For brown ink select a suitable aniline color that is soluble in water, and add a small quantity of alcohol and a little glycerine (1 to 4 per cent). The addition of these two ingredients is desirable in any case.

(37) E. S. writes: We have lately had our cistern cleaned. The water seemed perfectly clear and pure, without taste or odor; but as it had gotten quite low, and as the cistern had not been cleaned for several years, we thought it best to have it emptied and thoroughly cleaned. Since then, the water has had a very bad taste and smell, which we can notice even after it has been through the filter. Can you tell me why this is so? A. In cleaning your cistern you may have exposed the clean cement to the action of the water, which may have given it the taste of lime or alumina. As you do not tell us how it tastes or smells, we cannot well solve the mystery. The soot that was found in the cistern was no doubt derived from the smoke of soft coal, which deposits carbonaceous matter with a little pyroligneous acid upon the roofs where bituminous coal is used. This is washed into the cistern and becomes a deodorizer and disinfectant, finally settling as the black soot mentioned If the water tastes and smells of lime or alumina, it is all right. If of decayed animal matter, it is all wrong.

(38) A. & F. B. ask if there is such coke manufactured in any part of the States as is used for fuel in English locomotives, and where. A. The coke made at Connellsville, Pa., is considered the best made in the United States, and nearly equal to the best English coke. You will find the names of makers in any commercial agency reference book.

(39) J. W. K.—There is no special examination required for entering the classes at Cooper Union. You must be 15 years of age. Appear in person, with a letter of recommendation if possible from employer. By calling at the office in second story of the institute you may obtain a circular containing all needed information.

(40) S. L. W. writes: Will a Breguet upright galvanometer, such as is sold for $10, do for experimental work in electric measurement, and also asks how to construct a cheap rheostat to use with the same. As I am studying electricity out of school hours, I do not wish an expensive instrument for the present. I principally wish to measure the resistance of batteries, electro-magnets, and short stretches of outside wires, principally on a private telegraph line. A. The galvanometer referred to will answer a good purpose; but one provided with a horizontal needle would be more serviceable, as it would be more sensitive. You cannot readily construct a cheap rheostat without having a standard rheostat with which to compare it. An imperfect instrument of this kind is of no value whatever.

(41) J. S. H. asks: Can you inform me what causes the ivory on piano keys to turn yellow? Some I have recently seen change in a few months from a pure white. Others, many years in use, still retain their original whiteness. Please explain the cause, and suggest a remedy or preventive. A. The yellow color of the piano keys may be due to grease absorbed from the fingers of the player, or it may be that the piano sits in a dark place or is generally closed. Under these circumstances ivory is apt to turn yellow. There are also many kinds of ivory, and the inferior qualities do not retain their whiteness without precautions. Good ivory keys having a liberal exposure to the light ought to retain their whiteness for many years. Ivory is bleached by exposure to sunlight for periods varying from four weeks to six months, or by immersion in turpentine, kept near the surface, and exposure to the sun for three or four days.

(42) L. P. A.—We have frequently published articles on microscopy and upon all the modern investigations in this branch of science. It is possible that we may in the future publish elementary articles on the subject.

(43) S. E. K. F. writes: I have constructed a small pressure blower as described on page 75 of vol. xxxix., SCIENTIFIC AMERICAN, and get a fair blast through a ¾ inch tube, but I cannot contract it so as to serve as a blow pipe, as I desire. Please give directions as to construction of pipe from the fan to the bench, say four feet. A. We do not think you will find it possible to so change your blower with any form of pipe as to make a blow pipe with much, if any, additional force.

(44) W. C. M. asks how to refine whale oil soap, so that it will produce a white lather. A. You will be obliged to first refine the whale oil. Whale oil soap is usually made from the sediment produced in refining the whale oil. 2. What is "English crown soap?" A. English crown soap is an imported soft soap used by harness makers and the like for rubbing and polishing leather. 3. Also soap stock. A. Soap stock is the residuum from cotton seed oil and from olive oil.

(45) J. H. G. writes: 1. How much of 100 per cent of bitartrate of potash or cream of tartar can be dissolved in one gallon of boiling water? A. Cream of tartar is soluble in 18 to 14 parts of boiling water. 2. Cream of tartar manufacturers utilize all their waste products, by converting them into tartaric acid. Can I use any other test besides litmus paper, for absolutely determining if sufficient lime carbonate has been used, to perfectly precipitate the first equivalent, and secondly, what is a good test for determining if all the tartaric acid has been freed from the potash in using the sulphate of lime? A. To determine the acidity by other means than with litmus is possible. You can add a little cochineal solution to a portion of the mixture, and then pour in potassium hydroxide (caustic potash) until the coloring disappears. This reaction will show you approximately how much lime carbonate to add. 3. Would hydrate of lime added to very weak solutions of bitartrate of potash take the place of lime carbonate for freeing the first equivalent? A. The use of hydrate of lime would not be as effective as the carbonate. The tartaric acid decomposes the lime carbonate, and we do not think such a reaction would follow if the hydrate was used. 4. Can the sulphur be freed from the potassium sulphate? If so, how? A. Barium chloride will precipitate the sulphur from potassium sulphate, forming barium sulphate and potassium chloride. 5. What work in chemistry, published, can I get, that will thoroughly post me in this particular industry? A. There is no literature available on baking powders other than articles found here and there in the SCIENTIFIC AMERICAN and other similar journals. Blyth's book on Foods may contain some information suited to your wants.

(46) F. G. H. asks if there is any foundation in fact for the prevailing belief that tomatoes cause cancer. And if so, why? Or, rather, how do they operate—by poisoning the blood, or otherwise? A. The belief, which has become quite common, that tomatoes cause cancer is utterly without foundation. There is not the slightest ground for fear in using freely what is really one of our most valuable vegetables. At the same time, they ought to be used like everything else, with proper moderation. Even a good thing may be abused, and a person may become so extremely fond of tomatoes as to consume an excessive quantity, and thereby derange the functions of the stomach. The acid nature of the fruit would, in such a case, perhaps, cause canker sores in the mouth. But it must be understood that there is no resemblance between cancer and canker, except the similarity of spelling. Cancer is a malignant, frightfully dangerous disease; canker is merely a result of disturbance of the stomach, and is commonly of small importance except from the pain and annoyance it causes. But even for this the tomatoes are not fairly responsible, for though, as stated, it may sometimes follow their very free use, yet with most persons no such result would occur. 2. Have you ever set forth the wonderful power of red clover in curing cancer, a fact indisputable, if taken before death is inevitable? A. The belief in the efficacy of red clover is not very common; it is local, and has no better claim than that concerning tomatoes. Very frequently harmless tumors are considered to be cancers; in such cases the various popular remedies—red clover (*Trifolium pratense*), cancer root (*Conopholis Americana*), etc., are used, and when the tumor disappears, as of course it presently does, a "cancer cure" is falsely reported, and a reputation for a perfectly inert remedy is established.

(47) W. G. S. writes: I wish to make a telescope as described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 252, and would thank you to explain the following: 1. Diameter of object glass as given is 2½ inches and external diameter of tube 3 inches; drawing shows both of same diameter; which is right? A. The internal diameter of the telescope tube should be larger than the clear aperture of the object glass. 2. How thick should paper tube be? A. The thickness of the tube is of no consequence. 3. Please give diameter of field and eye lenses. A. The diameters of the field and eye lenses are unimportant if they are of the correct focal length. 4. Paper reads eye aperture should be 1¼ inches; should it not be ¼ inch? A. The aperture should be ¼ inch. 5. What combination of lenses would you recommend for higher and lower power eye pieces than that described? A. It is only necessary to preserve the same relation between the focal lengths of the field and eye lenses for higher and lower powers. 6. What gauge of wire is used for gas lighting spark coils? A. Almost any size of wire will answer for this purpose; No. 24 is often used. 7. What should be size of coil? A. The coil may be 6 inches long, 2 inches in diameter for three or four burners. 8. How many Leclanche cells will be required to light a single burner? A. From two to four cells.

(48) W. F. D. asks (1) proportions and ingredients for blue prints. A. Dissolve 40 grains ammonia citrate of iron in 1 ounce distilled water. Also dissolve 1 drachm potassium ferrocyanide in 1 ounce distilled water. The foregoing solutions are prepared separately and kept from the light. 2. Chemical reaction in making making blue prints? A. The ferric compound (ammonia citrate of iron) is by the action of the light reduced to the ferrous condition, which with potassium ferrocyanide produces an intense blue coloration similar to Prussian blue. 3. Chemical action of bicarbonate of soda in bringing out white lines on blue prints? A. The soda bicarbonate turns the picture to a lavendar color, and prevents its fading. A dilute solution of acid (citric or hydrochloric) will produce the effect described by you, as it dissolves out the superfluous blue and so brings out the white lines.

(49) W. H. P. asks how alumina soap is made, and also where I can find a description of the hot air engine. A. There is a soap now manufactured in this country, in which caustic soda is replaced by the aluminate of soda. The latter can be prepared either from bauxite or from cryolite. Bauxite is calcined with soda ash, whereby an aluminate of soda is formed, and the iron is separated by lixiviation, the resulting liquors being evaporated until a dry commercial aluminate of soda is obtained. Powdered cryolite is mixed with six equivalents of lime and boiled with water, when an insoluble fluoride of calcium is formed, and the alumina becomes dissolved in the excess of caustic soda. If an excess of lime is used, the alumina will be precipitated, leaving the caustic soda alone in the solution. For making soap from aluminate of soda about equal parts of lard and tallow are preferred, and these should not be heated to a greater extent than is just necessary to liquefy them. The materials are not boiled in the usual way, but the combination is effected at the lowest temperature at which they can be intimately mixed. Hot air engines are described in the SCIENTIFIC AMERICAN SUPPLEMENTS Nos. 162,247, 284, and 368.

(50) C. W. H. asks: Which is the best method of drying fish scrap after leaving a hydraulic press, whether by some machine or by a kiln? A. When steam is used for boiling and pressing, there will be economy in employing the waste steam, as well also as direct steam in coils of iron pipe in a drying room. Another plan is to make flues in brickwork under the floor of the drying room, making the floor itself of large tile laid over the flues, and carry the hot gases from the boiler furnace through these flues to the chimney, or, if not convenient, use a separate fire for the drying room flues. The slabs of scrap may be laid upon shelves. The coils of iron pipe may be made by any pipe fitting establishment.

(51) W. J. D. asks: Who was the builder of the first locomotive, and where first used? A. Cugnot, a Frenchman, made a small locomotive in 1769, which is still preserved in the Museum of Arts and Metiers, Paris. Watt took out patents from 1769 to 1784, on steam carriages or wagons, but not known to have made any. Symington made a model of a steam carriage in Edinburgh, in 1770. William Murdock built and actuated a locomotive in 1784, in Cornwall England. Oliver Evans, of Philadelphia, obtained patents in Maryland, U. S., in 1787, for the exclusive right to operate steam wagons on roads and railways. In 1803, a Mr. Fredericks built a locomotive for a mine in Hanover, Germany. Trevithick's first locomotive was running in 1802, and is considered the first effective effort on rails. Blenkinsop's locomotive, 1811. Hedley's locomotive, 1813, the "Puffing Billy." Dodds and Stephenson commenced their improvements in 1815.

(52) W. J. D. asks: 1. What is the best and most powerful battery for electro magnet? A. The plunging bichromate battery is the best for this purpose. 2. About how large should an electro magnet be, and how much wire in the coils, and what size, to lift a weight of 1,000 pounds, or as much as it will lift conveniently, at a distance of from 1 to 3 inches? A. An axial magnet would be better for your purpose than the ordinary form of electro magnet. The size of the helix and of the wire of which it is made will depend upon the kind of battery used and the manner in which it is connected up. It would be more or less a matter of experiment to determine the size of coil required to lift 1,000 pounds from 1 to 3 inches. 3. How is an electric reservoir made, and about how long would the electricity last in a reservoir 8 feet long, 4 feet high and 4 feet wide—8x4x4 feet—to lift the aforementioned weight at every second interval by disconnection of the wires? A. For information on storage batteries, consult SUPPLEMENT, Nos. 304, 332, 370, 215, and 354.

(53) J. H. K. asks (1) whether there is any metal or composition ("Delta" metal for instance) that will not rust or corrode when frequently used in water, and hard enough to bear as much friction (or more) as is required of ends of a sewing machine bobbin. Would bone, or zinc, or celluloid, or two of either do? A. Try phosphor-bronze. 2. Let me know also what is the best and cheapest battery to use to work on a line 40 to 100 yards long; and if a battery that is strong enough to work one telegraph instrument on a line like the above, how many more cells would be needed to work six or a dozen instruments on the same length of line? I would want the power of the magnets to be as strong if I had on a dozen as if only one or two, but do not know whether their power depends on the length of the line or on the number or strength of the cells of the batteries. What book or books would best teach me all these things? A. The power of the current on the line depends on the number of cells of battery employed; the gravity battery is probably best for your purpose. For full information on telegraph lines, instruments, and batteries, consult Prescott's Electricity and Electric Telegraph.

(54) S. A. H. writes: In your paper August 10, in No. 4 of Notes and Queries, you state that a carbureter for gas machine to supply 8 five foot burners should have 12 feet evaporating surface. I use Sisal hemp in my carbureting tank, the air passing over the fibers of the hemp, which have become saturated with gasoline; I therefore cannot tell what amount of surface I have. I use an iron tank 2 feet diameter and 2 feet high, fill it with hemp, and keep about 3 inches depth of gasoline on bottom; the air is introduced through a pipe, the end of which is under the surface of the gasoline; this is to supply five 6 foot burners; have carbureter in a cellar the temperature in which is sometimes as low as 32; use 88 gasoline. When weather is cold the gas is poor, making blue light. Is this the best way of making a carbureter? If not, will you please give directions for construction of a good one? A. Your carbureter is probably too small for cold weather. The iron tank in so compact a form absorbs heat from the surrounding air very slowly. Making it long and narrow is advantageous, or use two round ones. Any means that you can use for warming the air used in making the gas by taking it from the cellar will materially help the process. Some use hot water in a pan under the carbureter in winter. There are a great many patents on carbureters; you could not do better than to make them a study. Copies will cost 25 cents each. 2. Is chrome steel much better for lathe tools, etc., than the ordinary cast steel? Does it require different treatment, in forging and tempering, from cast steel? A. Chrome steel is good, but we do not know that it is any better than the best tool steel. The treatment in forging and tempering is the same as for tool steel.

(55) H. W. M. writes: 1. I would like to learn to read faces easily. Would you please inform me in Notes and Queries of a good work on physiognomy? A. To read faces easily is in a great degree a matter of personal faculty not easily learned. There is an excellent book called the "New Physiognomy," also one on "Comparative Physiognomy." 2. How are rings (finger) made? A. Finger rings are cast in moulds if heavy, or rolled out in bars, cut off the proper length, the ends hammered or rolled down to the proper size and bent into a ring around a mandrel; the ends are then cut and fitted for the desired size of ring and soldered together, then the rings are filed up and polished.

(56) C. P. K. writes that during the operation of a steam fire engine near his house, an iron leader shook very hard, so much so he was afraid it would break, seeming to shake in unison with piston rod of the engine. A. Probably the motion of the piston of the fire engine became synchronous with the vibrating properties of the leader, which induces vibration. This is a well known phenomenon in connection with bridges, which are often thrown into a severe vibration by a synchronous step or even the trot of a dog. 2. In your issue of July 12, you speak of the Payne process for preserving timber. Can you tell me what that process is? A. Payne's process for preserving timber consists in impregnating the wood, while in a vacuum, with a strong solution of sulphate of iron, and afterward forcing into the timber a solution of sulphate of lime, or any of the alkaline carbonates, such as carbonate of soda, by which means the oxide of iron becomes insoluble.

(57) J. W. S. asks: How can I harden the calks on horseshoes of malleable cast iron or of steel? A. The steel is low, or decarbonized, and like the iron is amenable best to casehardening. Heat the shoes so that the calks are red hot, either over a fire or in red hot lead, dip the calks in a pan of powdered prussiate of potash, and throw them into water.

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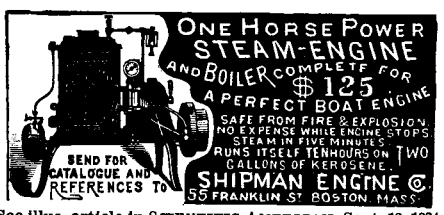

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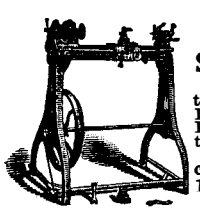

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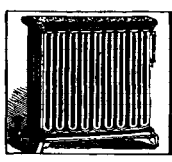

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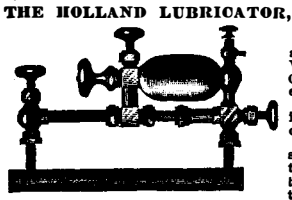

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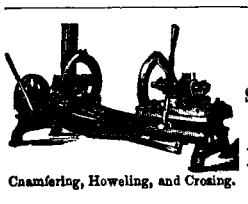

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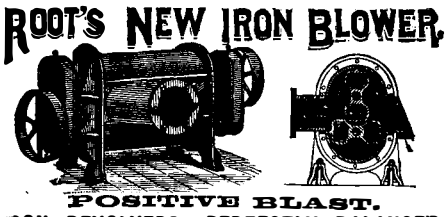

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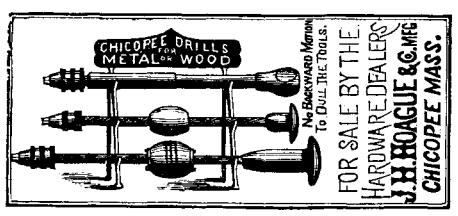
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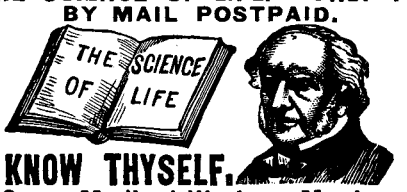

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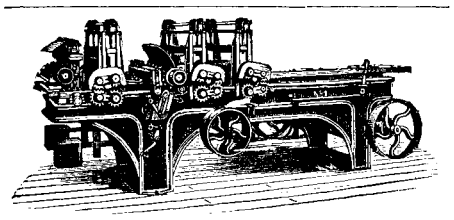

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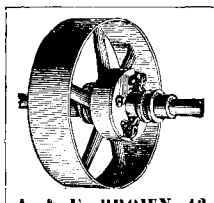

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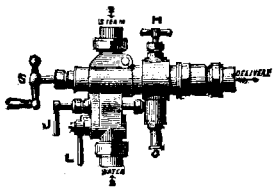

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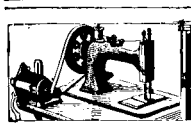

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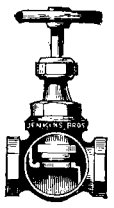

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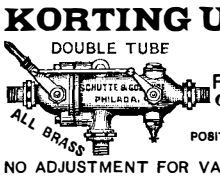

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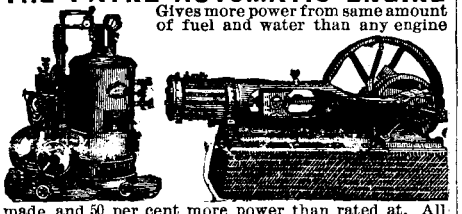

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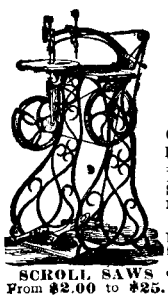

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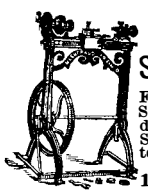

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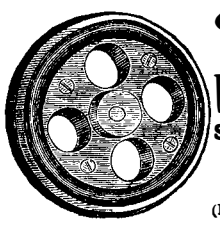

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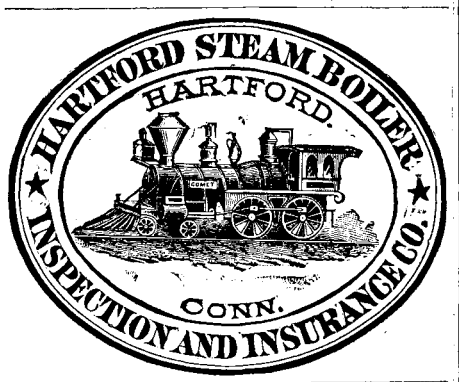

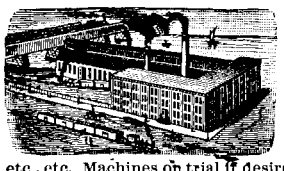

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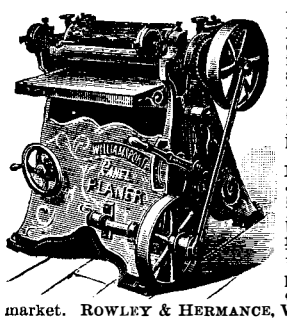

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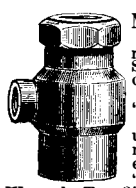

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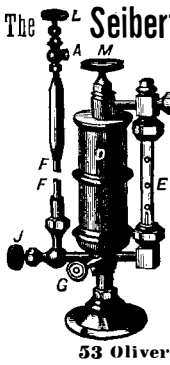

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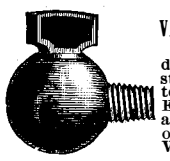

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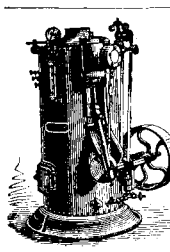

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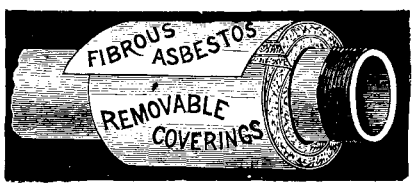

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THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts. Phila., and 47 Rose St., opp. Duane St., N. Y

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